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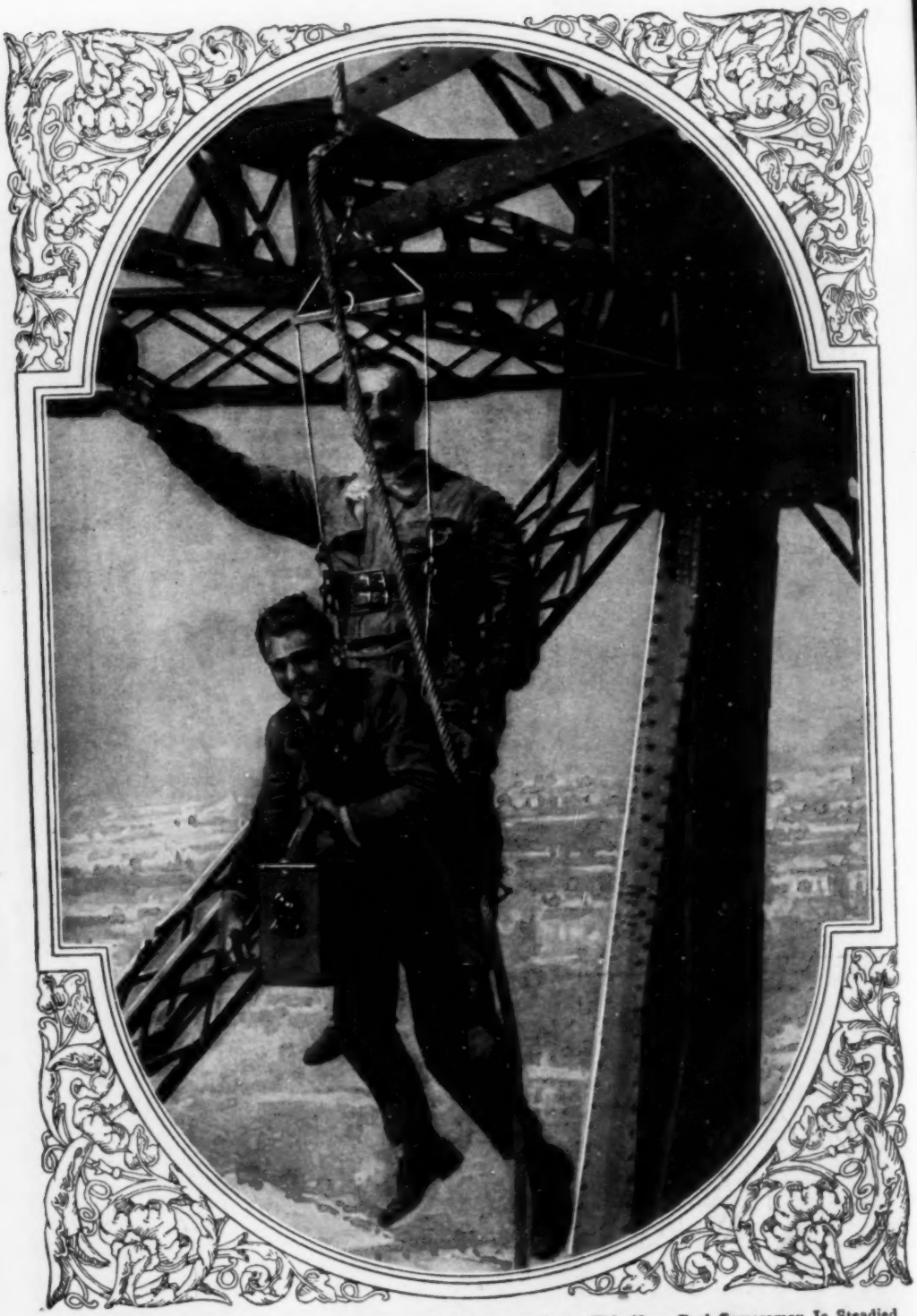

Swinging over Dizzy Heights from the Top of Eiffel Tower in Paris, This News-Reel Cameraman Is Steadied by a Steeplejack Whose Harness Supports the Intrepid Photographer—See Page 452

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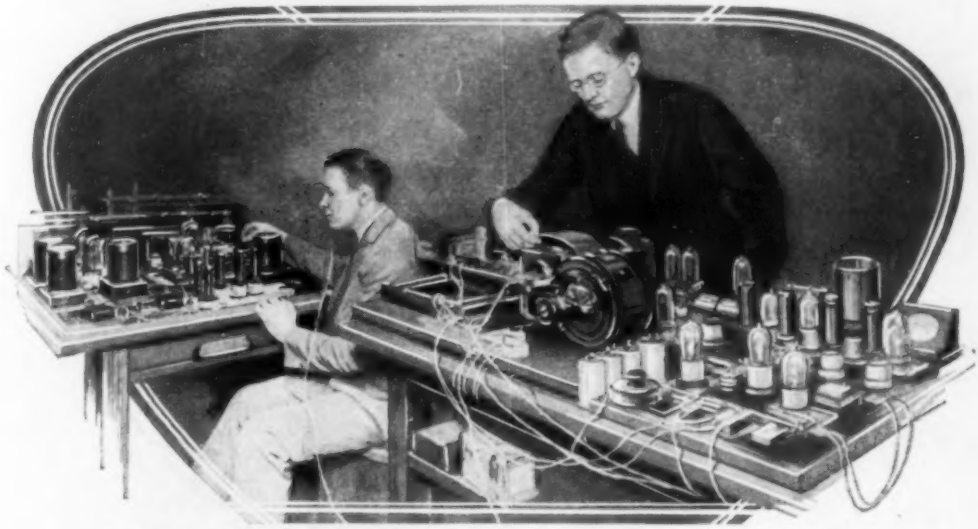


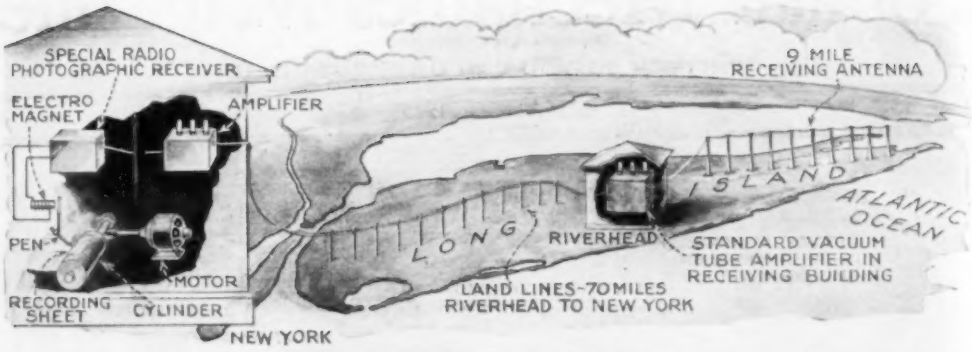
Radio Picture Transmitter in Foreground, with Operator Placing Film on Rotating Drum

Pictures Sent Across the Sea by Radio

Wireless Waves Transmit Photograph to London and Back Again so Rapidly That First Part Arrives While Last Is Being Sent

TWO successful experiments by inventors who achieved the same result almost simultaneously and demonstrated it within four days of each other, have added radio picture transmission to the successes of wireless. In the first experiment pictures were sent by radio from London to New York and one made the round trip, being dispatched from New York to the British capital, where it was automatically rebroadcast to this country, the first part of it being recorded side by side with the sending machine which was still dispatching the rest of the photograph. The second inventor succeeded in sending a picture of a message in Japanese characters from Washington to Boston, but discontinued his demonstration temporarily when it was discovered that the old naval station at Anacostia, near Washington, utilized for the transmitting end, did not have enough power to force the picture through static and code interference. The Japanese characters were received and recorded plainly, but the same film bore so much interfering code that the inventor said all that would be necessary to read the picture was a code book. The transatlantic demonstration,

Removing a Picture after Its Ether Journey



coming on the heels of the successful introduction of telephoned pictures early last summer, has made it possible to take pictures of happenings abroad and send them to America the same day, and then redistribute the picture by the telephone process to all parts of the country. Besides transmitting pictures, an old Chinese proverb, "One Picture Is Worth Ten Thousand Words," also was sent across the ocean.

Owing to the fact that the receiving apparatus had not yet reached London when the experiment was made, all the transmission was from England to America. The process, which was invented by Captain R. H. Ranger, of the Radio Corporation of America, utilizes a light-sensitive bulb to translate a beam of light, passed through the photographic film, into electrical impulses, which are then amplified and modulated in an ordinary radio-transmitting set, in the usual manner. At the receiving end an ordinary receiving outfit picks up the electrical impulses and passes them back through a light-sensitive cell to be reflected as a beam of light on a film in an especially constructed camera, and also to actuate a delicate lever holding a fountain pen, playing over a piece of paper attached to a revolving cylinder. Thus the picture is received in two ways. The paper gives a pen drawing, the lines and their length and heaviness being controlled by the shading of the original negative. The light beam playing in the camera gives a second picture, in the form of a photographic negative, which can be developed in the usual way, and from which as many prints as are needed can be made. The beam of light travels over every bit of the film, its intensity being controlled by the strength of the radio signal, and that in turn by the amount of light which can pass through the shadings of the original picture; hence the film at the receiving end, when developed, gives an accurate reproduction of the original. Perfect synchronism is maintained between the motors which drive the revolving cylinders at the sending and receiving end, though these motors are separated by 3,000 miles of land and ocean. They are kept in step by a tuning device which employs the constant pitch of a tuning fork.

Diagram of New York Receiving Apparatus, Nine-Mile Antenna and Recorder, with Prince of Wales' Smile as Received by Radio

Some of the received pictures were very good, and others not so clear. Based on present wireless tolls, the average time required to transmit a picture would represent a telegraph cost of about forty dollars. Magazines and newspapers frequently pay more than that for a picture of great importance, while to picture syndicate services supplying many newspapers the cost is not at all prohibitive.

The other inventor working on the same lines, C. Francis Jenkins, utilizes principles much the same in his device.

Thirsty Liners Carry Enough Water to Supply Town for Week

Enough fresh water to last a small country town a week or more must be carried in the tanks of the big ocean liners to supply the demands of the greedy boilers and the wants of the passengers on a single trip. One big ship carries about 5,000 tons for each voyage across the Atlantic. It is estimated that each passenger needs about five gallons of fresh water a day for all purposes, and as passengers and crew together make up a company of 3,000 or more on the average modern greyhound, the ship is provided with special tanks along the sides to carry the supply.

Steam Sterilizer for Dental Tools Has Automatic Shut-Off

Operated with alternating current from a wall socket, a steam sterilizer for dentists' instruments, automatically shuts off at the proper time, and is so arranged that the hot tools can be dumped out upon a napkin without touching them. Water is poured first into a small timing cup to secure the right quantity and then into a porcelain heating chamber below. There it acts as the conducting medium and begins to boil almost instantly. In about twelve minutes, it has steamed away. This automatically shuts off the current. Instruments dry quickly, are not subjected to lime deposits and are easily removed without danger of burning the fingers.

Emptying Tools, after Sterilizing in Steamer and Filling the Heating Chamber with Water

Padded Ear Mask Worn by Pugilist for Protection While Sparring

"Cauliflower" ears, sometimes exhibited with more or less pride by veterans of the prize ring, have little appeal to one welter-

Pugilist Wearing His Padded Mask to Protect Ears While Boxing with Training Partners

weight fighter. While sparring with training partners, he wears a specially constructed mask that completely covers his ears and reduces the force of blows that land upon them. The protector is fastened by a cord that is tied under the chin, and by a band attached to the front and extending to the rear, where it connects with a side strip.

Garage Built with Revolving Floors to Save Time and Storage Space

Considerable saving in parking space and time required to get the cars in and out, is claimed for a revolving garage London engineers have devised. Its floor is built in a series of separate concentric rings and each has a number of inclosures to hold an auto. Without disturbing any of the other machines, any car can be moved out simply by whirling the circular floor upon which it rests until its compartment is opposite the exit. Spaces are left on each of the outer rings to permit access to cars at the center. A garage of this type, with five floors, will hold 100 cars and because of the economy of space, lower storage rates are anticipated.

¶About one cent per day per person is spent for electric lighting in the home.

Fortunes Are Made in Prison Cells Despite Handicap of Steel Bars

While serving a two years' sentence at Atlanta, Ga., a prisoner invented a portable ice-making machine which is now being manufactured. Another convict devised a tool for making shoes, and when he was released from the Maryland state prison, he accepted a position at $5,000 a year with a shoe firm. A banker was able to build up a lucrative investment business that netted him $300 a day while in prison. A man convicted of the murder of a New York lawyer and sent to an asylum for the criminally insane, nevertheless managed the investment of the $20,000 he possessed in such a way that it grew to nearly $250,000.

Silver Foxes Grow Large and Sleek under Proper Care and Lose Their Wildness While Being Raised for Their Pelts

Man-Made Dens for Captive Foxes Duplicate Natural Haunts

With the development of silver-fox raising, an industry that is said to be growing rapidly because of the small amount of space required and the profits, increased attention is being given to the construction of the dens, that the animals may live in surroundings as nearly like their native homes as possible. As they are used almost exclusively by the female to hide and rear her young, they are considered highly important to successful breeding. The walls are made thick to keep out light and noise, and an inner chamber and runway leading to the den are constructed to give the animal a sense of security. The sides of the pens are sloping and the floor is covered with woven wire so the animals cannot burrow out. In winter time, the favorite place for the foxes seems to be on top of the dens and here they curl up together and sleep in the open regardless of low temperatures. Fox pelts sell at from $200 to $1,000 each, and pairs of the animals for breeding bring higher prices.

¶ Weighing more than a ton, a Holstein cow owned by the University of Idaho, produced 20,995.7 pounds of milk in one year.

Airplanes as Pilots for Ships in Fog Guide Way into Harbor

Employment of airplanes to guide ships into harbors in foggy weather has been suggested following the experience of the carrier "Langley" that was piloted safely into Pensacola bay with the help of aviators. The boat arrived at daylight. A light fog reduced visibility to four miles or less, and though the low shore could be seen, there were no marks to guide the navigators to the wharf. Several airplanes were carried on the flying-off deck for immediate delivery on land. One of them was launched and after circling about, the entrance was located and by means of signals, the flyer pointed out the proper course.

Check Protector Carried in Pocket Stamps Figures in Colors

As a means of safeguarding bank checks against raising and forgery, a pocket-size protector, for which patent has been asked, stamps embossed figures in two or three colors. The device, which is disk-shaped, resembles a dial and can be carried without injury to the clothing. Pads of different shades of ink are provided, so secret combinations of color may be arranged and registered with banks by the owner, as a key to aid in establishing the genuineness of the signature. Each character can be quickly cut into the paper by pressure of the thumb on the stamp, perforating the written inscription to make

Vest-Pocket Protector Which Stamps Colored Figures on Checks to Foil Criminal Tampering

erasure difficult. Specially designed letters and figures may also be furnished on the protector as an additional guard.

Armless Artist Holding Brushes in Teeth Paints Pictures

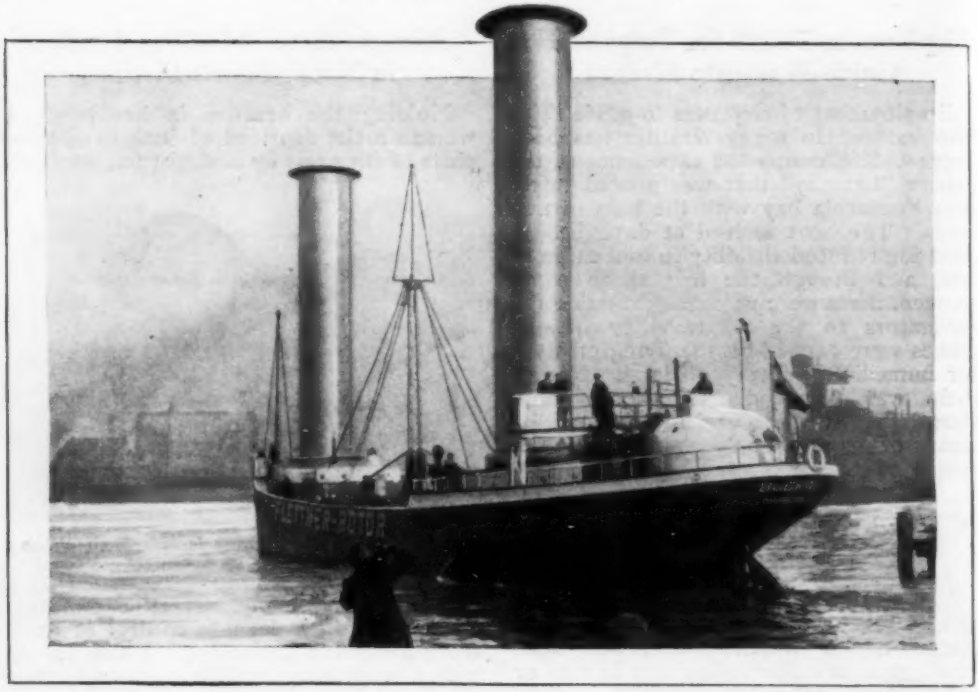
Holding the brushes in her teeth, a woman artist deprived of both hands and parts of the arms by accident has succeeded

Armless Artist, Holding Brush in Her Teeth, Putting Last Touches on a Painting

ed in painting many attractive pictures. By developing a delicate control of neck movements the artist applies the colors with a proficiency rivaling painters having all physical powers. Even on difficult portrait work, the disabled craftswoman easily reproduces likenesses which are highly valued for their workmanship and beauty. The armless worker uses ordinary materials and can manipulate pencils and other drawing accessories with little effort, although she employs a horizontal surface instead of the usual upright easel.

Single-Crystal Copper Bar Carries Thirteen Per Cent More Current

Copper capable of transmitting thirteen per cent more electricity than present conductors has been produced in small bars made up of a single crystal instead of an aggregate of closely packed ones, such as are found in ordinary metal. One of the drawbacks to long-distance power transmission has been the energy loss due to resistance of the wire. Should single-crystal copper conductors become a commercial possibility, smaller wire could be used and practically twelve per cent of the copper in transmission lines could then be released for use in other fields. The crystal bars were made by gradually heating and cooling pure copper in an electric furnace. They were about the size of a lead pencil, but if bent, the metal lost its special electrical properties, the large crystal being transformed into a mass of smaller ones.



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The Rotor Ship "Buckau" Being Driven by Its Two Flettner Rotor Towers in the First Test Run on the Bay at Kiel, Germany

"Sailless" Ship Startles Shipping Men

Revolving Towers Extract Power from Changed Air Pressure and Save Eighty Per Cent of Cost of Operating Vessel

A REVOLUTION in freight shipping, where economy in operation and not speed is desired, is forecast by shipping men as the result of the invention of a "rotor ship" by Anton Flettner, a German engineer. The invention, hailed as the first new development in sailing ships since the earliest navigators discovered they could utilize the wind's power, has been tried out successfully, it is reported, on a 600-ton schooner at Kiel, and two more ships of the same design are now under construction. The motive power of the Flettner rotor vessel is two hollow steel towers, ten feet in diameter and sixty-five feet tall, built up of thin steel plates and mounted on pivots on which they are revolved by nine-horsepower motors. The power which moves the ship, however, comes not from the revolving towers, but from the air which strikes them. They are, in reality, sails, but the manner in which they extract power from the air is based on an obscure natural phenomenon which is so little understood that even scientific men have trouble in explaining it in simple language.

The phenomenon is what is known as the Magnus law, or "Magnus effect," a discovery made in 1853 by Professor Magnus, a German, who found that when a current of wind struck a rotating cylinder it exerted a force approximately at right angles to the direction of the wind. The discovery interested scientists, but they found little practical application for it. Artillery officers measured the amount of the effect and made allowance for it when firing in a cross wind. Tennis players also discovered it, and many years ago Lord Rayleigh wrote a treatise on "The Irregular Flight of a Tennis Ball," but until Flettner developed his rotor ship about the only persons who had found a way to utilize the Magnus effect were baseball pitchers. Their curve balls depend entirely upon this counterforce for their curves.

Flettner himself did not know of the

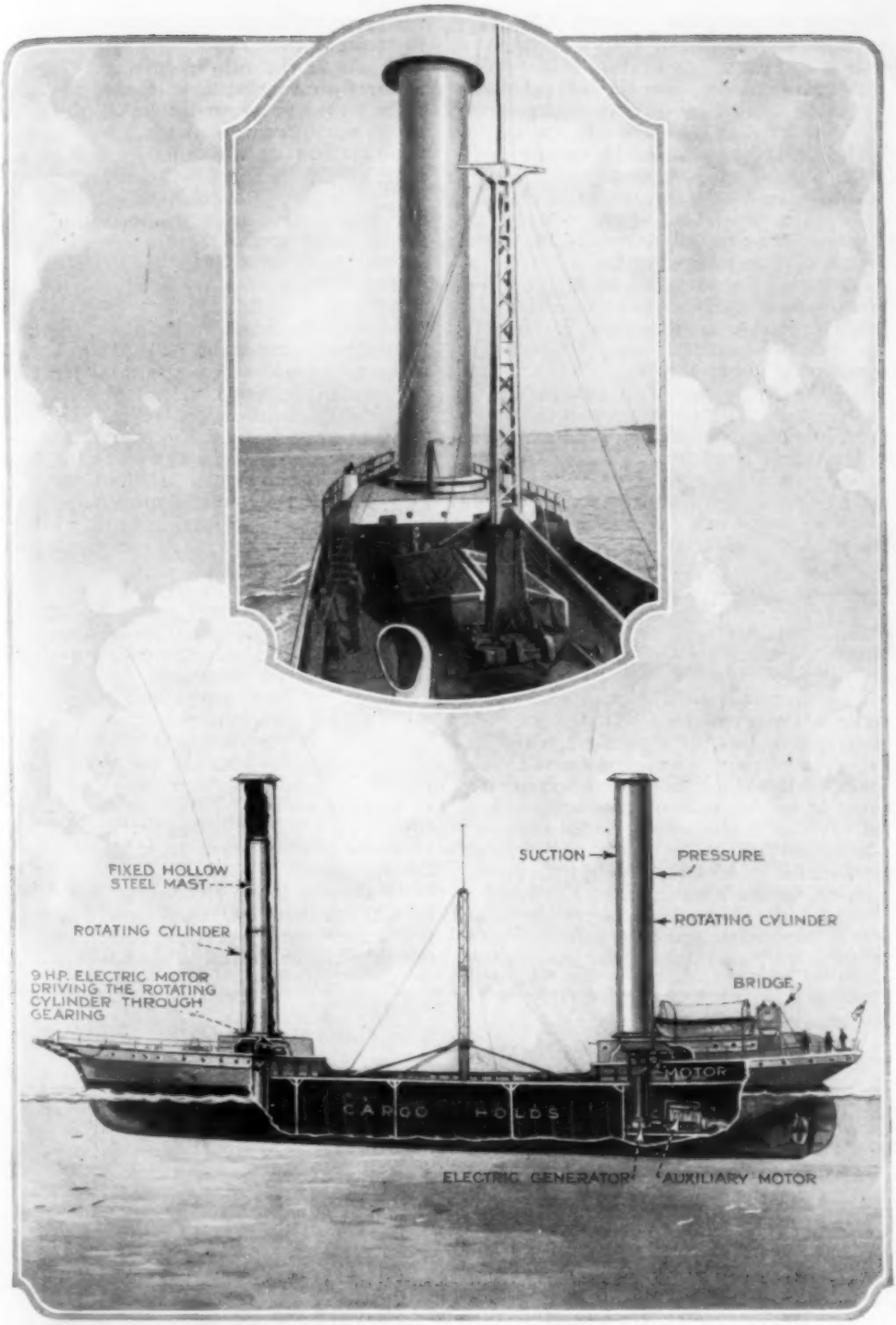

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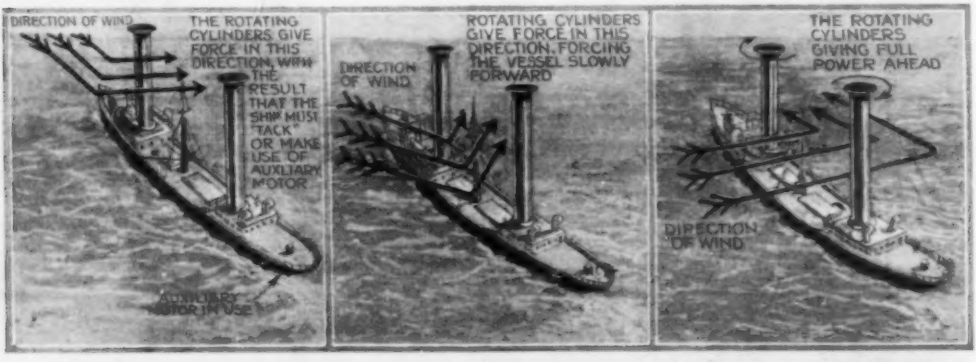
Diagram of the Rotor Ship Showing Vast Cargo Space Made Available by Eliminating Usual Engines, and, Above, a Close View of One Rotor

long dead professor and his discovery when he started work. He had invented a patent rudder which bears his name and was trying to devise a sailing ship with metal sails, mounted in sections or vanes like the familiar auto-radiator cover, except that the vanes should extend vertically instead of horizontally. His idea was to have fixed sails, with the movable vanes controlled by power, to eliminate the large crew of sailors needed to handle the sails of an ordinary ship. During his experiments he stumbled upon the effect first observed by Magnus and that led him to the professor's earlier reports. He constructed two identical ship models, one equipped with ordinary sails and the other with two small revolving towers moved by clockwork, and experimented with them in the glass-inclosed wind tunnel at Goettingen university. The experiments were so successful that a motorship company commissioned him to fit large-scale rotors to one of its vessels, the schooner "Buckau." The first trials were made in a November gale, and the vessel maneuvered perfectly. It outran other sailing vessels, and even passed freight steamers. The experiments showed that when the towers were revolved at about four times the velocity of the wind that struck them, the maximum speed was attained. Turning at 100 revolutions per minute, the towers, or rotors, develop a circumferential speed of about fifty feet a second. The effect of the wind striking the revolving tower is an increase of pressure, with a decrease of wind velocity, on the side where the wind strikes; and a decrease of pressure with a corresponding increase of velocity, on the opposite side. The peculiarity of the Magnus effect is that the area of decreased pressure and increased velocity, will, at certain tower speeds, extend as much as three-fourths way around the tower, while the increased pressure is confined to the other fourth. With the tower operating at four times the wind velocity, the pressure developed proved to be about fifteen times as great as the wind's effect on an ordinary sail of the same area. The result is that a rotor ship with only one-fifteenth the "sail" area of any ordinary vessel can obtain the same speed, while at the same time it is more stable, easier to control, and can be operated by one man from the bridge instead of a large crew.

Equally important is that the rotors can be stopped, started or reversed in a second, as contrasted with the comparatively long time it takes to make sail or take in the sails on a full-rigged vessel. On certain routes—particularly the Asiatic—where the trade winds may be counted on to blow ninety per cent of the time, it is estimated that a rotor ship, equipped with an auxiliary engine for use during calms, could be operated at a saving of eighty per cent over a sailing ship.

The steel towers on the "Buckau" are so built that frictional loss of power is reduced to the minimum. A hollow steel tube runs up the inside of each tower for three-fourths of its length, ending in a pivot, on which the revolving cylinder is hung. The nine-horsepower motors had no trouble in revolving the cylinders during the tests. No matter what the velocity of the wind and the speed of the ship, it requires no more power to revolve the towers than it does in a perfect calm, since they are perfectly smooth, with no vanes or projections.

By altering the speed of one tower it is possible to turn the vessel to one side or the other, and by reversing both towers the ship can be moved backward.


DIRECTION OF WIND
THE ROTATING CYLINDERS GIVE FORCE IN THIS DIRECTION, WITH THE RESULT THAT THE SHIP MUST "TACK" OR MAKE USE OF AUXILIARY MOTOR
AUXILIARY MOTOR IN USE
ROTATING CYLINDERS GIVE FORCE IN THIS DIRECTION, FORCING THE VESSEL SLOWLY FORWARD
DIRECTION OF WIND
THE ROTATING CYLINDERS GIVING FULL POWER AHEAD
DIRECTION OF WIND

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The "Buckau" Can "Sail" Almost into the Wind, as Middle Diagram Shows, While Greatest Speed Is Attained When Course Is at Right Angles to Wind, on Right

Trolley Scoop Rips Up Old Asphalt and Loads It on Cars

A scoop which rips up old asphalt paving from between street-railway tracks and loads it on cars in a fraction of the time required by the pick-and-shovel method has been designed for attachment to the ends of work cars. As the apparatus is moved ahead by trolley power, steel points are forced under the paving, peeling it off in large strips which are pushed up an inclined platform and rolled onto the bed of the car. As each car is loaded, the scoop is detached and coupled to an "empty." It is said considerable expense is saved by the combination machine which lifts old street surfaces much the same as a banana is peeled.

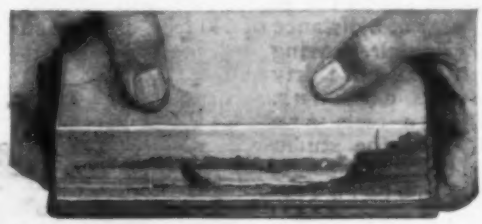
Traction Scoop Lifting and Loading Old Street Paving; Below, Ready for Work

Eye of Camera Is Extended to Pierce Fog and Smoke Screens

The power of the camera is being extended by experimental work undertaken by government experts so that pictures can be taken through fogs and mists and, possibly, dense smoke screens. Airplane photographers with the aid of special filters, film and plates of extreme sensitiveness are now able to take pictures of smoky cities on cloudy, misty days with astonishing results. Many of the discoveries made in connection with the tests are being guarded closely as military secrets.

Art of Ancient Book Makers Revived as Ornament for Modern Works

Recalling an artistic practice of old-time book craftsmen, modern binders are reviving the custom of decorating leaves of volumes with pictures that can be seen only when the edges of the pages are spread out by bending them in a mass when the book is closed. This exposes a thin line of colors on the extreme outer margin of each page which form a solid design when properly joining. While the ornamental work is being applied the leaves are tightly closed and clamped so the edges remain as an inclined surface. After the paints are dry, the pages are allowed to resume their normal position and the edges are gilded or covered with "marble" effects, completely hiding any of the colors which might show when the book is shut. Sometimes both sides of the margins are treated, different pictures being used to produce the double finish.



Courtesy The Christian Science Monitor
Skillfully Painted Picture on Edge of Book Revealed When Pages Are Drawn Back

Modeling Plaques from Sealing Wax Proves Popular Fad for Women

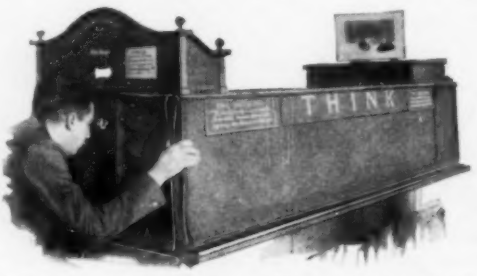
Ordinary sealing wax is the material a Chicago woman employs for modeling decorative plaques with bird, flower and other designs. Melted over an ordinary alcohol lamp and applied directly from the stick, the wax is easily worked into realistic figures, adheres tightly to the surface and has a brilliant, glossy surface when dry. Paints are used to develop the color schemes and emphasize details. Instruction in the art is given to a number of women, who have found it a pleasant and easily learned way to make attractive gifts and ornaments for the home.

Copyright, Underwood & Underwood

Class in Wax-Modeling with Samples of Their Work and Alcohol Lamps, About the Only Tool Needed

Telescope Tests for Outdoor Signs Reveal Defects before Posting

To help artists design the most effective sketches for its outdoor billboards, a large western sign company uses an instrument which shows the poster as it will actually appear at a distance of 640 feet, or from an automobile moving at the rate of thirty miles an hour. These tests are done in the studio with small paintings, before the sign is officially accepted and put upon the boards, and are said to save the company costly errors in choosing the wrong colors or compositions for the displays. The apparatus used is a dark box, eight feet long and three feet wide, made of wood, covered with heavy green canvas and mounted on a table. At one end is inserted a pair of lenses and at the other, back of a strong electric light, is placed a reduced copy of the proposed sign, painted in the chosen colors. When the observer peeps through the lenses, he sees the poster just as though it were mounted at a distance of 640 feet, and can thus make changes in the sketch, if necessary, to improve its effectiveness. The motion test is performed on the same box. There is a disk on top, similar to that of a phonograph, with a rod for holding the sketch. By giving the platform a spin with a rope and peeping through a hole above the lenses, the critic will see the poster as though he were looking at it from a speeding automobile.



Testing Sketch of Sign by Looking at It the "Long Way" through Telescope Lens

Heartbeats Charted by Electricity to Aid in Study of Disease

Electricity and photography have been enlisted in the treatment of heart disease at Johns Hopkins hospital in such a way that a patient under observation may lie in a ward or room while in another building half a mile away, the beatings of his heart are being recorded in alternately thin and heavy lines with curves and angles indicating the actual movements of the organ. A specialist wires up his patient as if the latter were a radio set, the most important part of the apparatus being a string of glass coated with silver and so small as to be almost invisible. Three records are taken, first by connecting the string to the two arms of the subject, the second by attaching the right arm and the left leg, and the third, the left arm and right leg. To interpret the photographs,

mathematics is applied to the curves and angles of the lines traced by the heart-beats. Some scientists now believe that the heart acts as a sort of battery, giving off a discharge to set itself in motion.

Paper Cups for Hot or Cold Drinks Made in Sanitary Cabinet

Individual paper drinking cups, sealed with a strip of metal and with an edge of double thickness so as not to cut the lips, are fashioned at the turn of a crank in a sanitary cabinet now on the market. It is designed to eliminate the use of glue and the necessity of touching the cups with human hands before they reach the drinker. Each container is cone-shaped and at the turn of the handle on the cabinet, is cut from a roll of sterile paper long enough to make 1,000 cups. It is delivered to the user through a slot at the front of the box. The cabinet may be used as a vending machine by fitting a coin-receiving mechanism to it, to release the crank. Hot drinks also can be held in the strong, clean paper without danger of leaking; the rim of the cone is kept open, making the cup easy to fill and drink from, and its shape fits the hand. Many kinds of paper

Views of Cabinet and a Cup with Strip of Metal That Seals It

cups require glue or other unclean substances in their manufacture, and are touched several times in packing and in filling the vending devices. Making the cups as they are wanted from the roll in the sanitary cabinet is designed to overcome most of these difficulties.

¶ Our Bureau of Information will answer all questions regarding articles appearing in this magazine.

Electric Furnace for Heating Knives Prevents Furniture-Shop Fires

Furniture makers, before their goods are permitted to be shipped from the factories, carefully inspect all pieces for dents

Knife Furnace in Use on Workman's Bench, and Inset Showing Its Construction

or abrasions that may occur in handling the articles. When any such imperfections are found, they are filled in with a special kind of wax that must be melted and worked into the wood with knives. To eliminate the danger of fire from blow-torches or other implements used to heat the wax and the tools, a small electric furnace that can be placed upon the work-bench and supplied with current from the light socket, has been invented. It will hold two knives at once, if furnished with an asbestos base, and the metal in the heating chamber is of a kind that will not rust or scale. The heater requires but little electricity and weighs only two pounds.

Monkey Markets at Steamer Docks

Around the docks in London and Liverpool, a considerable trade is done in monkeys for organ grinders. Most of the animals arrive on sailing vessels from India and South America as the big liners do not bother with such traffic generally, and the longer voyages give the monkeys time to become accustomed to the climate. They are usually sold at prices ranging from $3 to $25, depending upon their size and state of health, and are then disposed of through agents for the brokers who get commissions for finding customers. While in the hands of the middlemen, the monkeys generally are given good treatment with plenty of warmth and food and ample room in which to play and fight.

Short Waves Promise Long-Distance Radio

Senator Marconi's New Beam System Leads to Improved World-Wide Wireless Communication

By C. A. OLDROYD

A RADIO-TRANSMITTING station talks to the whole world. Its huge antenna sends out waves to every point of the compass. When radio was young, this was considered the greatest advantage of the new system of communication, but later experience showed that, in many cases, it also proved its most serious drawback.

The radio-sending station may be compared to a powerful electric arc lamp burning on a tall tower. Close to the arc, the light is intense and even overpowering, but at a distance from the lamp, the illuminating power falls off very quickly. So with radio. The energy fed into the transmitter is spread in all directions, and only a very small fraction reaches a distant receiving station.

Marconi, who gave radio to the world, was the first to recognize this great weakness of present-day systems, and as the result of many years' research, has developed the "beam" system, which marks as great an advance over the usual long-wave system as the searchlight proved to be over the exposed arc lamp. To prevent the scattering of light, and to illuminate far distant objects clearly, the arc lamp must be turned into a searchlight by adding a reflector, which will project a narrow but very penetrating beam in one direction only. After many experiments, Marconi has succeeded in applying this principle to radio. While the ordinary type of transmitter radiates energy in all directions, the beam system, like a searchlight, projects a narrow beam of radio waves toward the receiver. In this way the energy is concentrated on the receiving station, and efficient transmission becomes possible with very low powers.

Furthermore, the messages can be kept secret. Up to the present, the only way to keep a message secret was to send it in code, for thousands of stations were able to listen in. This meant delay, and often serious mistakes were made during the process of coding and decoding. With a beam-transmitting station, receivers outside the beam cannot read the message, just as the searchlight cannot illuminate objects outside the pencil of light it projects. Marconi's experiments with directional radio date back nearly thirty years, and in a recent lecture before the Royal Society of Arts, in London, he traced the gradual evolution of the radio beam system from its very beginning. The first beam transmitter was constructed in 1896. With the aid of reflectors, communication could be kept up over a distance of one and three-fourths miles, while without reflectors the range was but half a mile.

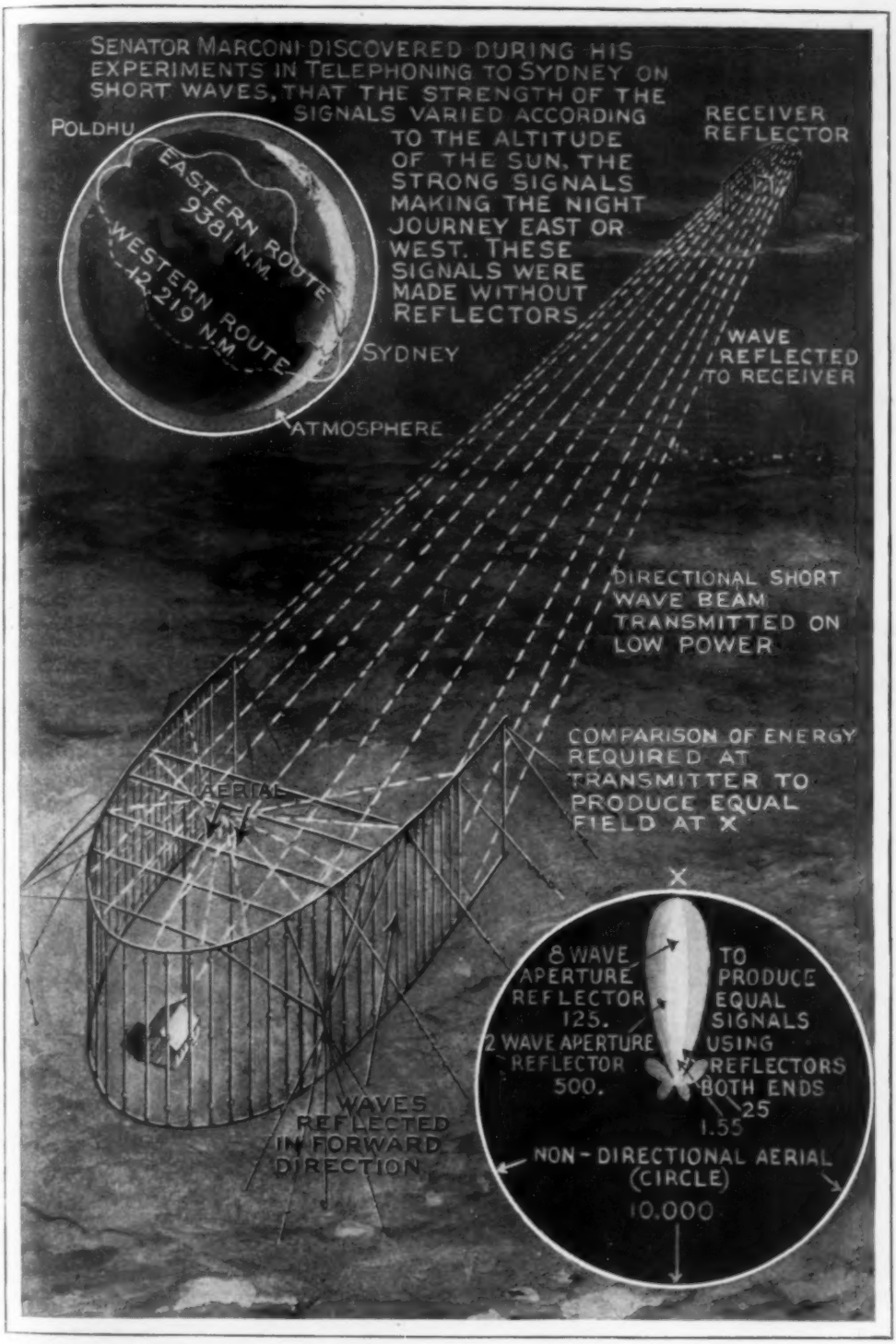
In the meantime, the long wave of 10,000 meters and more conquered the field for long-distance work. With such immense wave lengths, beam radio was out of the question, for efficient reflectors would have measured miles in height and length. A successful system of short-wave transmission had to be perfected before reflectors could be thought of, and in many years of ceaseless experimenting such transmitters were evolved step by step. In 1917, Marconi succeeded in bridging a distance of over twenty miles, with a transmitter using waves only three meters long. The transmitter only was fitted with a reflector. These experiments were carried out with a new type reflector, as the curved metal sheets used in the earlier experiments would have been too heavy and cumber-

Marconi's Message to Readers of Popular Mechanics

IN radio more than in other forms of science, the amateur experimenter has assisted the professional worker, and many now famous engineers began their careers as amateurs.

I am proud of the fact that I began my radio experiments as an amateur, and look back upon my early efforts with the greatest pleasure.

It is up to the amateurs to make radio better known and to win more members for the already world-wide fraternity of radio enthusiasts.


SENATOR MARCONI DISCOVERED DURING HIS EXPERIMENTS IN TELEPHONING TO SYDNEY ON SHORT WAVES, THAT THE STRENGTH OF THE SIGNALS VARIED ACCORDING TO THE ALTITUDE OF THE SUN. THE STRONG SIGNALS MAKING THE NIGHT JOURNEY EAST OR WEST. THESE SIGNALS WERE MADE WITHOUT REFLECTORS
POLDHU
EASTERN ROUTE 9381 N.M.
WESTERN ROUTE 12,219 N.M.
SYDNEY
ATMOSPHERE
RECEIVER REFLECTOR
WAVE REFLECTED TO RECEIVER
DIRECTIONAL SHORT WAVE BEAM TRANSMITTED ON LOW POWER
COMPARISON OF ENERGY REQUIRED AT TRANSMITTER TO PRODUCE EQUAL FIELD AT X
AERIAL
X
8 WAVE APERTURE REFLECTOR 125.
2 WAVE APERTURE REFLECTOR 500.
TO PRODUCE EQUAL SIGNALS USING REFLECTORS BOTH ENDS
25
1.55
NON-DIRECTIONAL AERIAL (CIRCLE)
10.000
WAVES REFLECTED IN FORWARD DIRECTION

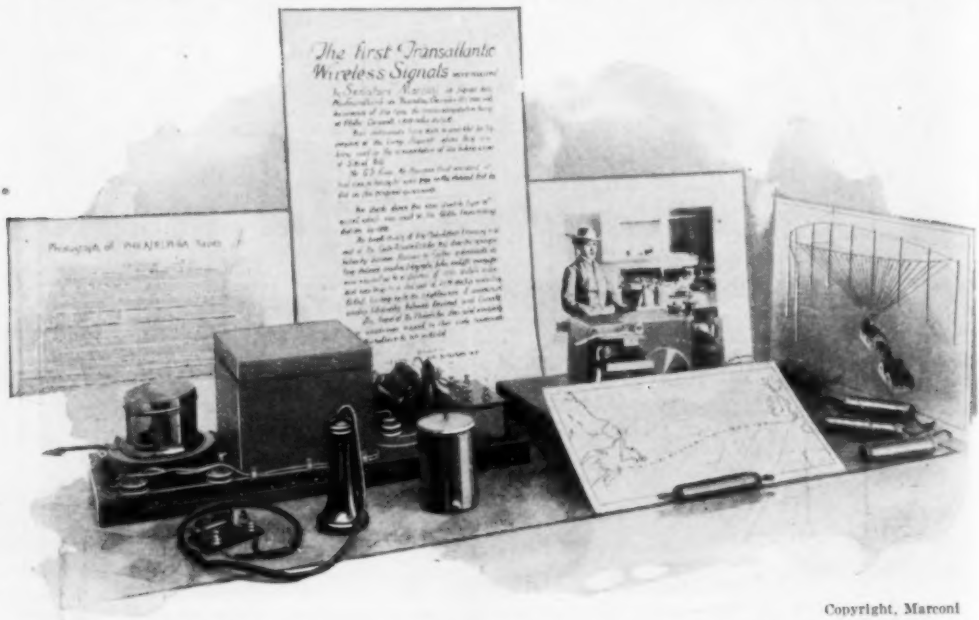
Copyright, The Sphere

Marconi's Aerial Reflector Throws a "Beam" of Radio Waves to Receiving Station and Reduces Power Consumption from 10,000 Units to 125

Senator Marconi Seated in the Wireless Room of His Steam Yacht "Elettra"

some for practical work. The new reflector consisted merely of a number of vertical wires spaced around a parabolic curve; the antenna was located at the focal point. The reflector wires were also tuned to the wave length used.

In 1923, an experimental transmitting station was erected at Poldhu, England. The receiver was fitted on board Marconi's yacht, the "Elettra." His intention was to steam farther and farther from the transmitting station and to compare the strength of the signals. Owing to structural difficulties, no receiving reflector could be installed on board the yacht, so a single vertical wire, whose upper end was seventy feet above sea level, served as antenna. The results obtained were surprising. A wave length of ninety-seven meters was employed, and twelve kilowatts were fed into the eight transmitter tubes. Even without using a reflector at the transmitting station, clear signals were received throughout the whole of the twenty-four hours when 780 miles from Poldhu, although the signals weakened during the daytime. To test the short-wave system over still greater ranges, the transmitter at Poldhu was redesigned to absorb up to twenty-one kilowatts. Without reflectors, the daylight range was increased to 1,400



Copyright, Marconi

Instruments Used in the First Transatlantic Wireless Test in 1901, on Display with the Marconi Exhibit at the British Empire Exposition

"SUNSPOT" CRATER EJECTING CLOUDS OF GASES AND METALLIC VAPORS
TAIL PARTICLES REPELLED BY LIGHT PRESS
LARGER PARTICLES GRAVITATING BACK
RADIATING STREAMS OF SOLAR IONS
IONS CLUSTER-THICKER AROUND MAGNETIC POLES CAUSING AURORAS
MEDIUM PARTICLES IN SUSPENSE CAUSING CORONA
IONS ARRIVING WITH GREATER VELOCITY PENETRATE FARTHER INTO STRATOSPHERE CAUSING IRREGULARITIES
HEAVISIDE LAYER
STRATOSPHERE
A POOR CONDUCTOR BY DAY
A POOR CONDUCTOR BY NIGHT
AN EXCELLENT CONDUCTOR PERMANENTLY IONISED
TROPOSPHERE
A POOR CONDUCTOR
MILES
DAY
NIGHT
SAME AT NIGHT

Copyright, The Sphere

Radio "Fading" Explained by Irregularities in Layer of Electrified Dust Particles, Known as the Heaviside Stratum, above the Rarefied Atmosphere of the Earth, Which Reflect Back Wireless Waves

nautical miles. At night, and for some hours at dawn and sunset, strong signals were heard at Long Island, New York, and even at Sydney, Australia. A station situated in Montreal, Canada, found it possible to work with Poldhu for sixteen hours out of the twenty-four.

Confident of success, Senator Marconi now attempted radio telephony between England and Australia. A wave ninety-two meters long was employed, and twenty-eight kilowatts were fed into the oil-cooled transmitter tubes. For the first time in history, a voice speaking in England was heard, practically at the same moment, in Sydney, Australia, on May 30, 1924. This result was all the more surprising as neither sending nor receiving station used a reflector.

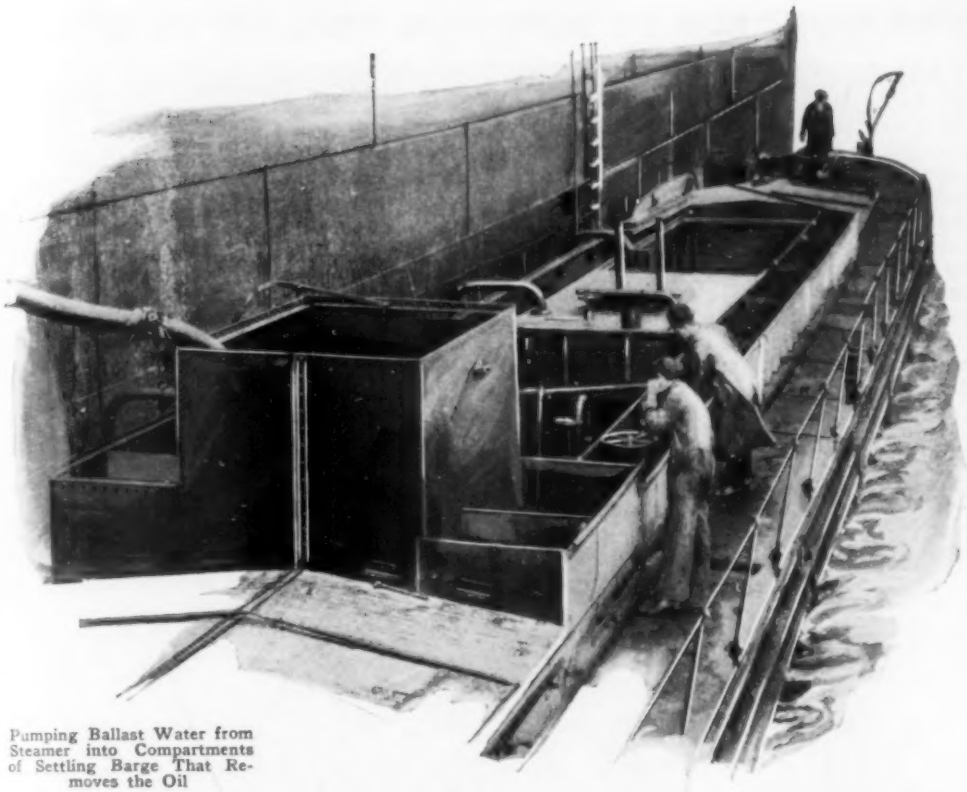
Thanks to recent improvements, it is now possible to construct short-wave beam stations of as much as fifty kilowatts. Such stations are far cheaper to build than the giant long-wave stations used for long-distance work at the present time. For broadcasting, too, the beam system has great advantages, for the owner of a simple and inexpensive crystal set who is situated in the path of the beam, will obtain quite as good reception from distant stations as the owner of an elaborate multi-tube set.

Recent experiments also have given a clue to the reason for the "fading" of radio signals, as well as the improved reception at night. Above the six-mile belt of earth's atmosphere lie fifty-four miles of more rarefied air, and then a layer of electrified, or ionized, dust particles, called the Heaviside stratum, in honor of the man who discovered it. This stratum is made up of the minute dust thrown off by the sun and the tails of passing comets, and repelled by the pressure of the solar-light radiation. Its under surface is very irregular and is always in uneasy motion. The wireless waves which reach it are reflected back toward earth, but because of the irregularities and constant motion of the ions, the amount of reflection varies, and fading is the result. By day the stratosphere, or rarefied upper air, is also ionized, but does not reflect because of its patchy conductiveness, so that all upward waves are lost, and only those passing parallel to the earth, through the exceptionally poor conductor of the lower air, are received.

Golf Courses Laid Out on Lawn with Special Tees and Markers

Golf links of nine or eighteen holes can be adapted to the lawn or to small parks and fields with the aid of a set of tees and markers devised by an eastern inventor. Thus persons, who have little opportunity to visit a regulation links, will have more chances to enjoy the thrills of the "ancient and honorable game." Large figures are placed on the markers to indicate the number of the holes, and smaller digits with arrow pointers show par. The tees are disks of rubber, which prevent injury to the grass, and the hole signs have sharp wicket supports which can be inserted easily and leave no trace when they are pulled out. A nine-hole course can easily be arranged on a 50 by 150-foot lawn. As constant practice is considered one of the most important requirements for a good game, this "vest-pocket" course is specially suited to the player who is likely to become "rusty" through lack of time to go to a public or club links. The shots require just as much skill on the lawn course as they do in the regular game although there are no opportunities for long drives.

Golf in Your Own Yard Is Possible with Tees That Protect Grass and Set of Markers for Holes



Pumping Ballast Water from Steamer into Compartments of Settling Barge That Removes the Oil

Barge Rids Ballast Water of Oil to Protect Fish and Birds

Oily ballast water, poured from steamers into rivers and harbors, has been found so destructive to fishes and birds, besides polluting streams and ports, that penalties have been imposed by the British government on vessel owners who allow oily liquids to escape into navigable waters. The step was followed by considerable complaint from shipping companies forced to send their boats to the three-mile limit to empty their ballast tanks. To solve this problem, an English company devised an oil-separating barge which is moored alongside the vessel and receives the ballast water as it is pumped out. The barge is divided into a number of compartments by bulkheads and as the oil-mixed water passes through them, the oil is separated and the water finally discharged overboard. As much as 200 tons of oil have been recovered from one steamer.

¶To help deer that have fallen into the flume of a western hydroelectric power plant, ladders have been built reaching to the top.

Dash Control for Auto Generator Saves Gasoline and Batteries

Operated by a lever from the automobile dash, a control for changing the charging rate of the generator to suit driving conditions has been placed on the market. It shifts the third brush in the direction the armature revolves, to give a high rate, and the reverse operation produces a low rate. The entire apparatus is contained in an end bracket for the generator with a rod connecting it to the lever on the dash. Use of this attachment makes it unnecessary to take the car to a garage for altering the charging rate, and quickly adapts the car correctly for operation in the city or in open country and for night driving.

"DRAGON" RUN BY MEN ADDS REALISM TO MOVIE

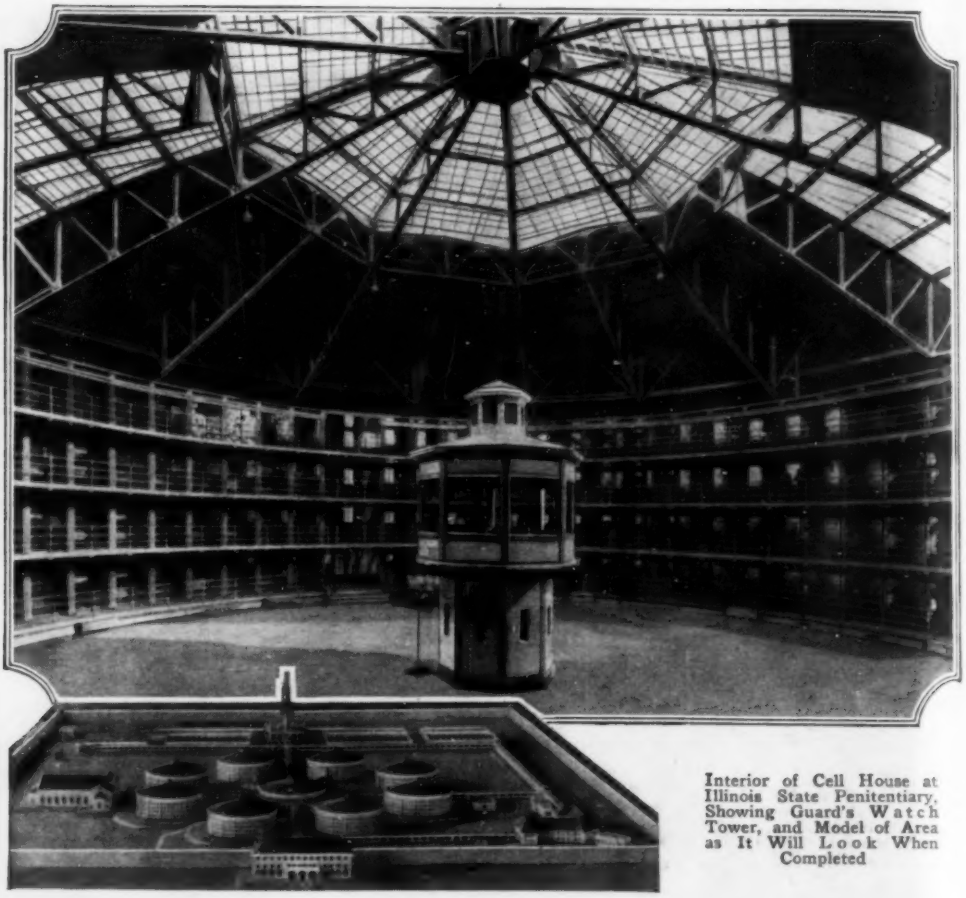
A realistic "dragon," operated from the inside by seventeen men, has been built for a German motion-picture studio. The exterior has been carefully modeled from reproductions of the dinosaur, and the interior is fitted with an elaborate arrangement of electric lights to guide the hidden actors, while suction and force pumps, and bellows, have been installed so that the replica may imitate, in true fashion, the movements of a living animal. For instance, the pumps and blowers can be operated to make it appear that the figure is drinking water from a pool, and breathing is represented by lifelike contraction and expansion of the chest. The "crew," carefully drilled to its task, performs its part in such a way that the dragon crawls slowly along a narrow ravine, apparently lifts itself into a tree, rolls its eyes and, true to tradition, shoots fire and steam from its mouth. A struggle with the hero of the play is an incident in the film story, and in this, what appears to be blood gushes from a wound inflicted by a sword. Several months were required to build the model and train the men who guide it. Specially designed machinery was installed inside the monster on rigid bases so the writhing movements of the great reptile could not interfere with its operation by dislodging or buckling the mechanism. An arrangement of "sights" for the crew controlling the propelling machinery was provided by inserting small peep windows in the thick spines on the forward part of the figure. Besides furnishing a means of ventilating the interior, this aided the operators in guiding the dragon and permitted each man to plan his action in advance of the signals given for the manipulation of the various controls responsible for the fantastic antics of the lizardlike hulk. Before the weird scenes were "shot," care was taken to give the ugly head a ferocious appearance by drenching the grinning jaws and ugly teeth with a fluid which dripped from the mouth in imitation of drooling.

Left, Preparing the "Dragon" for the Fight with the Hero, Staged in the Swamp Shown Below

the top.

country and for night driving.

Artist's Conception of How Mechanical "Dragon" Was Made to Play Realistic Part in Weird Scenes of Motion-Picture Production by Seventeen Men Who Worked Controls



Interior of Cell House at Illinois State Penitentiary, Showing Guard's Watch Tower, and Model of Area as It Will Look When Completed

Sunlit Cells in Circular Prison House Controlled from Central Tower

Circular prison houses with tiers of cells controlled from a central observation tower within the structure have been built on the new state penitentiary grounds at Statesville, Ill., near Joliet. The arrangement eliminates the need of a guard at each floor, gives better ventilation and admits light to practically every cell. The doors of each prisoner's room are built mostly of glass with just enough steel grating to discourage any attempt to break through. This likewise permits better illumination and enables the guard to keep constant watch of every inmate. The circular units are grouped about a cylindrical central building, housing the main dining room and all the structures are inclosed within a wall more than a mile long and thirty-five feet high. Though there are sentry houses at each corner, the custom of having the guards walk the wall has been abolished. Each cell house contains 248 compartments, is 150 feet in diameter and 45 feet high. The new buildings occupy part of the prison area of 2,193 acres and were formally opened not long ago just before convicts were transferred from the old institution at Joliet.

Safety First Taught by Phonograph to Children in Public Schools

As part of a safety-education campaign in Chicago, a phonograph record outlining the dangers of the street which children should avoid, has been prepared by a motor club and distributed in the public schools. It stresses the folly of roller skating, riding on sleds and playing ball in the thoroughfares, and urges the young folks to take pride in being cautious for the sake of their families and their country as well as for their own good. The record has been sent to all classes that use phonographs for instruction purposes under the approval of the superintendent of schools.

Zinc-Alloy Coating on Iron and Steel Prevents Rust and Takes Polish

Iron and steel are said to be made rust-proof and other metals are protected from corrosion by coating them with an alloy of zinc by a process devised after many years of experimenting by an English firm. It is not a plating operation for the alloy is said to become thoroughly incorporated with the basic metal so that there is no chance of peeling or chipping off. The method is reported to be cheaper than electroplating and the color and finish it produces resemble those of silver. A brilliant luster can be obtained by buffing.

Ranger's Horsepower Cyclometer Simplifies Measuring Trails

Visitors at Yosemite national park have been treated to the unusual sight of a stalwart forest ranger on horseback, cantering along the forest trails and holding in one hand what appears to be a polo stick mounted on a bicycle wheel rolling on the ground. The apparatus and the rider are engaged in serious business, however, for this is the method that E. C. Solinsky, chief forester of the park, has devised for measuring the 600 miles of road and trails that lead through the region. The wheel, in its frame and extension handle, records distances on a cyclometer mounted in the same way that

Forest Ranger Measuring Trails on Horseback with Bicycle Wheel and Cyclometer Attached to Stick

the instrument is carried on a bicycle. This system is sufficiently accurate for its purpose and is far cheaper than surveying.

Manicure Set Worn on Neck Ribbon Holds Tools in Hollow Handle

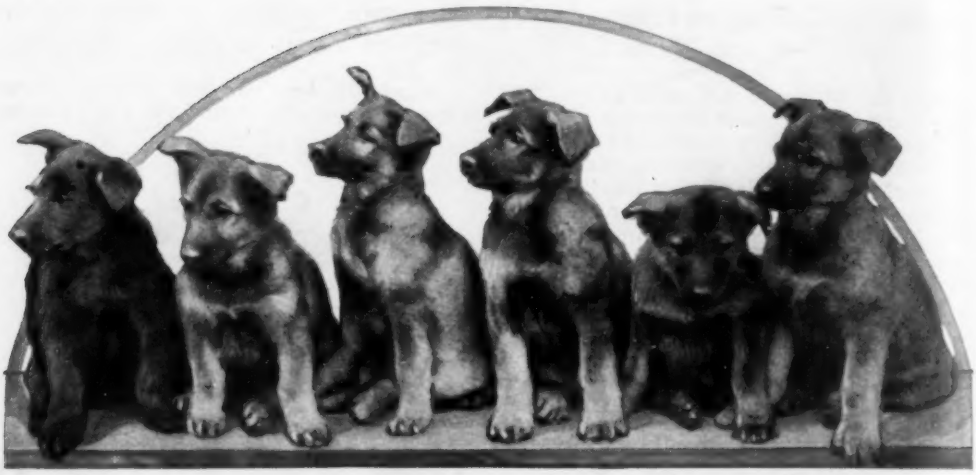
A manicure set so small it can be hung on a ribbon worn around the neck carries

Compact Manicure Set Which Holds Instruments in Handle and Can Be Carried like Fountain Pen

all the various instruments in a hollow tube which forms the handle for the articles when in use. Any of the tools may be adjusted in place in a few moments and are as easily manipulated as the ordinary kinds. Resembling a fountain pen, the compact set is small enough to be carried in a purse or pocket. The parts are protected against loss or rust and injury by a closely fitting cap.

Fabric Patch for Auto-Tire Casings Mends Balloons or Cords

Life of auto tires is said to be prolonged for 1,000 to 5,000 miles and breaks in balloon or cord casings are quickly repaired with a non-stretching, reinforced fabric patch recently placed on the market. It is said to be the only satisfactory means of mending balloon tires. The patches are applied with cement by the same method used in mending a tube, and the road heat and air pressure vulcanize the material in a short time. The fabric can be built up in several layers thus reconstructing the tire wall with a section of the same pliability as the casing itself.



To Train Your Dog

Animals Enjoy Learning and Respond Quickly to Proper Teaching Which Makes Them Valuable Guards and Comrades

By ALBERT PAYSON TERHUNE

FIRST of all, you must know more than your dog. Second, you must not only be able to teach him, but to do it in a way that he will enjoy and remember. Third, you must have patience, a fund of gentle firmness and, above all, common sense. Naturally, these traits also imply self-control.

There in a short paragraph, is summed up the whole theme of dog training. There is no magic, no mystery, about it. Anyone can do it—anyone who is sufficiently well stocked with the traits I have just set forth. It seems simple enough. Rightly done, it is absurdly simple.

Remember, above all, that your dog is not a Daniel Webster. He is an inferior being, who is at your mercy and who must rely on you for everything. Your six-year-old child would not learn fast at school, were his teacher to accompany the lessons with yells of rage and with curses and blows and kicks. The same applies to your dog. If you can't control your own temper, how can you expect to control him? If you can't keep cool and patient, don't try to train him.

I have dwelt somewhat at length on this; not as a preamble, but as the needful foundation of all dog training. Without this foundation, your work will be useless. Decide, in the beginning, just what you want your dog to learn. Cut the list as low as possible. Teach him few things; but teach those thoroughly. Never teach him anything new until he has mastered every detail of every former lesson in such a way as to remember it at word of command.

Best begin with him, if possible, as a puppy. The first and indispensable lesson is obedience. You can teach him nothing else until he has learned that. As soon as he has learned that you are his master, that he must look to you for his food, his exercise, his play—to you and to no one else—he will begin to obey you. Be his constant companion during this time. Let nobody else make friends with him. Obedience and master love will follow quickly.

The first thing to teach him, ordinarily, is to lie down in some designated place and to stay there. Press his hips slowly and steadily downward, saying all the time, "Lie down! Lie down!" Under the pressure, he will sit down. As he does so, shift your hand to his shoulders, always repeating the same words, until the shoulder pressure has made him lie down. Then praise him as if he had done some dramatically fine thing. Feed him a bit of liver or other titbit. Go through the same performance of pressure and oft-

repeated command several times. In a day or so, or after the second or third lesson, he will understand that the words "lie down" are a signal for him to lie down. This without the pressing hand. Next, point to some spot where you want him to lie and repeat the words. Almost at once—often the first time—he will move to the designated place and lie there. Soon, the mere motion of the finger will make him go to the spot and lie down with no word of command. Always follow each lesson with praise and some kind of reward.

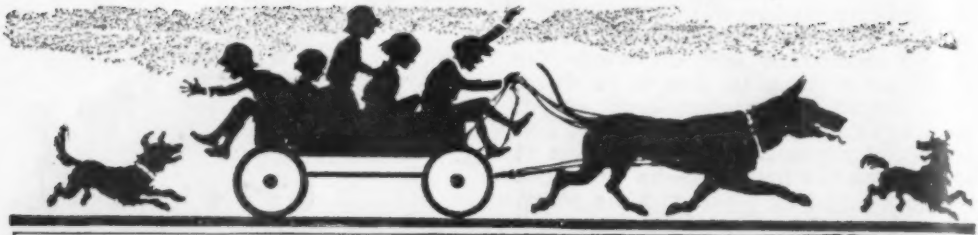
Next—especially if you are in a city or on a motor-infested road—comes the need

Well-Trained Pointers in Sight of a Quarry Cautiously Indicating the Presence of Game

to teach him to "heel"; in other words, to walk close beside or close behind you. This can be done by ordering him back whenever he starts to run forward, accompanying the order by the command, "Heel!" Better still, take him out on a leash and pull steadily in on it as he moves ahead of you, saying "Heel!" over and over.

Very soon he will understand what you mean, and will drop back at the first repetition of the word. Teach him to walk thus beside or behind you, until you give the order "Go ahead!" with a gesture to explain its meaning. A dog that has learned to heel, has made himself immune from many traffic perils.

Another traffic guard may be practiced to advantage by pulling on the leash as a street crossing is reached and by saying, "Wait!" Hold him thus for a few seconds



Canine Guard of Bank Messenger Receiving Lessons in Defense of Parcel

Most Dogs Are Easily Taught Amusing Tricks by the Exercise of Patience and Kindness

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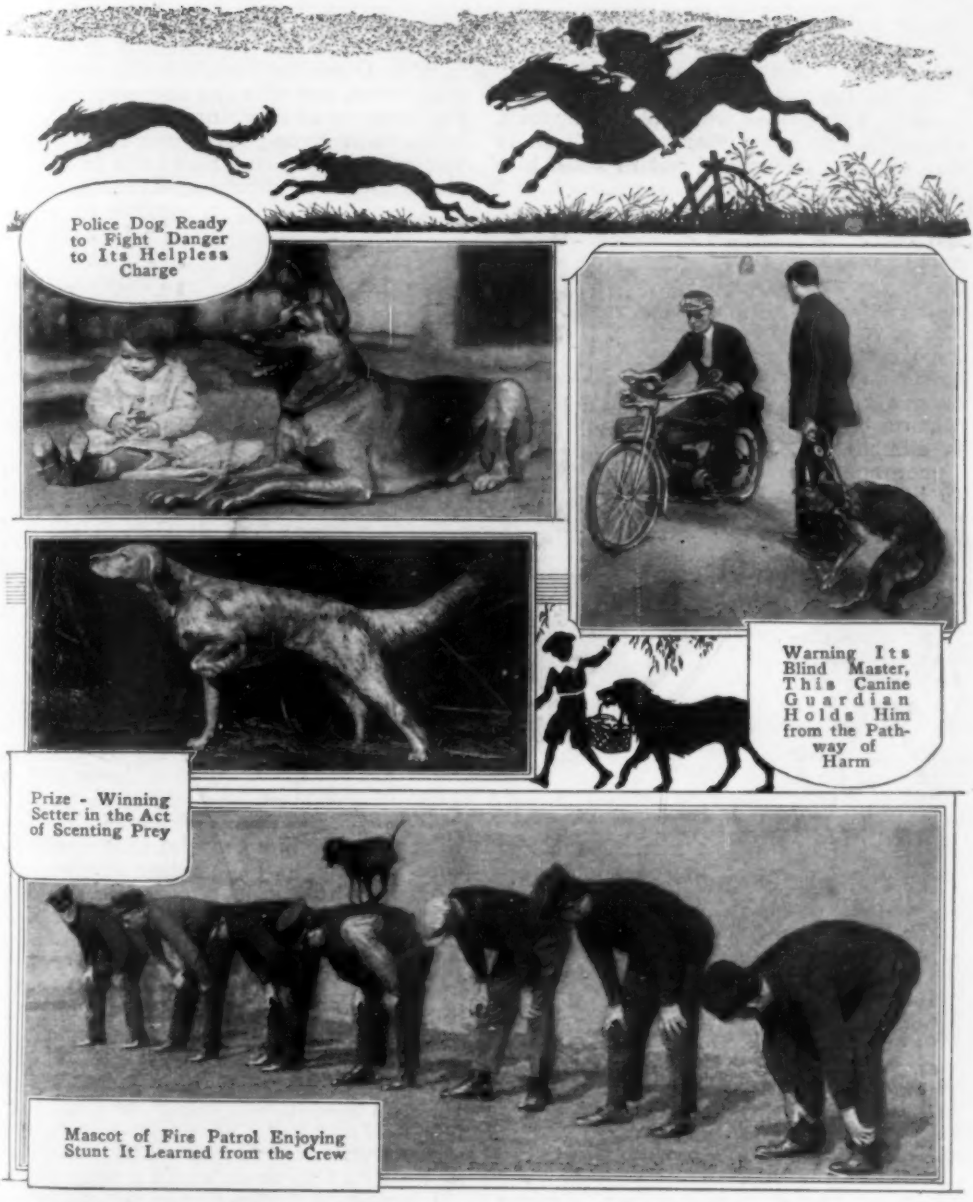
Rare Pose by a Willing Terrier

to walk close beside or close behind you. "Wait!" Hold him thus for a few seconds


Police Dog Ready to Fight Danger to Its Helpless Charge
Warning Its Blind Master, This Canine Guardian Holds Him from the Pathway of Harm
Prize-Winning Setter in the Act of Scenting Prey
Mascot of Fire Patrol Enjoying Stunt It Learned from the Crew

and then say, "Go ahead!" Before long, on reaching a crossing, he will know enough to halt of his own accord and to wait there until you give him the signal to go on.

I have known scores of dogs that do this, thereby saving themselves from sudden death under the wheels of passing cars. It is a simple and necessary thing to learn.

It is still simpler—if more drastic—to teach your dog to avoid poisoning by refusing to take food from a stranger. After you have taught him to look to you alone for food, etc., leave the room and let some stranger offer him a titbit. As the dog reaches forward for it, let the stranger snatch it back, slapping the dog lightly across the mouth. A few such lessons will teach the pupil that it is unsafe to accept food offered him by any outsider. It is a cruel thing, in a small way, this slapping of a friendly dog. But it is less cruel than to let him die in agony from

eating poisoned food. Also, it is better than to have him stolen by someone who may try to tempt him along by gifts.

By the time your dog has learned that your home is his, he will probably appoint himself a volunteer guard of it. That is dog nature. Be careful not to scold him severely if, at first, he barks at some friend who enters the house. By making him think he must not sound the alarm, you may keep him from sounding it sometime when a burglar is climbing in. Encourage him to bark at any outsider's approach. Praise him for doing it. In course of time, he will learn to distinguish friend from foe and to save his barking or growling for the latter. Here is something else that is worth while teaching him. Make him lie down; lay your coat or some other article between his forepaws and say, "Watch it!" Then move away. The chances are that he will try to follow you. Make him lie down again, replace the coat between his paws and repeat the command. Move away again; this time a little farther or even out of his sight. It may take a number of lessons to make him understand he must stay where he is until called by you, and that he must watch over the article left in his care. But, soon or late, he will always grasp the idea.

Ready for Breakfast; a Puppy Well on Its Way to Become a Highly Educated House Pet and an Interesting Companion

Transfer the coat to the seat of your car, when you take him riding. If you leave the car, make him lie down on the seat, guarding the coat. Quickly he will learn that he is to guard not only the garment but the car as well. A resolute watchdog, on the seat of a car, is better thief protection than a dozen patent locks. Few thieves will venture aboard a car where such a dog is growling defiance.

As to housebreaking a dog, some dogs learn this imperative duty by instinct. Most of them have to be taught it. Some learn it in a lesson or two. Some require longer time and more patience. But all will learn it eventually, if rightly taught. Often the fault lies with the heedless owner, not with the dog—especially if the latter be an immature puppy. In such cases, to beat the poor youngster is senseless cruelty. Be sure that he is let out of the house often enough and that he is not made to stay indoors too long at a time. Punish dereliction by a sharp scolding, at the time — never later, when he may not understand what you mean. Then put him out of the house in disgrace. He will learn the meaning of such scoldings and will profit by them. Don't beat him for these transgressions. A scolding is enough.

Never call a dog to you to punish him. That will give him the idea that disobedience is one way of avoiding retribution. Always go to him to punish him. A dog just learning to obey often becomes disobedient through being called to his master to receive a whipping. I have raised and trained two or three hundred collie puppies, without once striking one of them. Yet my dogs obey me implicitly. I insist on one-hundred-per-cent obedience. If you find it really necessary to use corporal punishment on your dog, slap him over the loins with a loosely folded newspaper. It will scare and humiliate him quite as much as would a whip slash.

I have said that a dog is not a Daniel Webster. While he is glad to learn when rightly taught, yet sometimes he does not understand what you are trying to teach him. Thus, when you find he is becoming scared or confused in the course of a lesson, turn the lesson into a romp or otherwise break it off and let him get over his fatigue or bewilderment. Don't keep on trying to teach him at such a time. You will only give him a terror of the task and you will achieve nothing. Take your time. You will save time that way in the

Dog Movie "Star" Studying a Radio Loud Speaker in Action

Firemen's Pet Which Attends All Alarms, Posing at the Wheel of the Apparatus

Group of High-Grade Pets Trained to Imitate the "Huskies" of Eskimo Land

Courtesy of Dogdom

Airedale Taught to "Caddy" for the Archer by Carrying a Quiver of Arrows

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Ready for the Game of "Fetch the Stick," Pastime for Both Boy and Dog; Left, Climbing Hunter Scaling a Fence Too High to Leap; Insert, Young Racing Whippets Undergoing Training for Exciting Chase after the White Rag

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long run. If you become discouraged over your dog's progress, there are two things to remember for your own consolation. One is that dogs differ as much as do humans in the speed wherewith they can learn, but that all rightly taught dogs will soon or late master their lessons. The other is that it takes only a comparatively short time to educate any dog, and that thereafter, for the rest of his life, you will have an ideal comrade and guard who will carry into effect all his lessons with no further effort on your part. Surely that is worth a little time and patience.

Typewriter Run by Motor Power Makes Uniform Key Strokes

With a small electric motor attached to the key mechanism, a typewriter of standard make is now being manufactured to reduce the stenographer's labor and to improve the quality of the work. The arrangement is somewhat similar to a German machine which has been in use in that country for several years. A light touch on any key engages the motor in such a way that the stroke and spacing are automatically completed. The chief advantage claimed for this apparatus is that the type bars are pressed down with uniform force, assuring a neat-looking page. Greater output and less fatigue for the operator are additional advantages that recommend the innovation.

New Steel for Use in Shipbuilding to Reduce Weight of Vessels

Steel that can be rolled into thin plates weighing considerably less than those usually employed in shipbuilding has been produced by an English chemist, it is reported, presenting a way of greatly reducing the weight of vessels without sacrificing strength. Heavier cargoes without increase in horsepower are seen as a result of this discovery and the new steel

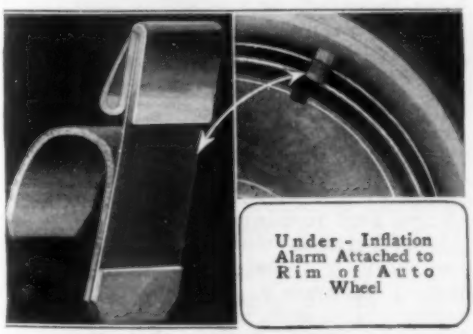
already is being used in the construction of two ships for the eastern trade. It is said to effect a saving of eight and one-half per cent in weight over the usual material. Increased elasticity is also claimed for the steel which, like many other inventions, was the direct result of an accident. The chemist was called to test some plates that had been used in the construction of a stranded steamer. He came to the conclusion that they did not have sufficient "stretch" and immediately began experiments toward preparing steel with greater elastic qualities and corresponding reduction in weight.

Airplane Is Made Nearly Noiseless without Decreasing Power

By means of an improved exhaust and a propeller that operates on special gears, eliminating the usual whir, British engineers are said to have devised an airplane that is practically noiseless without sacrifice of speed or lifting power. At the same time, by increased use of internal bracing, much of the noise caused by the wind rushing through the wires and spars has been avoided.

Alarm Tells When Tires of Auto Require More Air

An under-inflation alarm for pneumatic tires has been invented which is claimed to warn motorists when a tube has become flat or loses enough air pressure to reach the danger point. The device, which is fitted between the wheel rim and the tire, is sounded twice during each revolution of the wheel and is sufficiently loud



Under-Inflation Alarm Attached to Rim of Auto Wheel

to attract the attention of the driver even above the noise of surrounding traffic. The signal can be mounted either on the inside or outside of the rim and remains inoperative until ten pounds or more of air has escaped from the tube.

Wheelbarrow Bench for the Lawn Is Easily Moved by One Person

Benches for the lawn or garden are useful and ornamental but cannot be moved easily from place to place as needed. This

With Handles at One End and Wheel at the Other, This Decorative Bench for Lawn or Garden Is Easily Moved About

limitation has been overcome in a seat which an Englishwoman has invented. It combines the features of a bench and a wheelbarrow and may be trundled about as easily as the latter article by means of two long extension handles and a wheel at the other end which forms part of the support.

Self-Rescuer to Give Miners Chance to Flee from Poison Gas

Danger of mine deaths through smothering by poisonous gases is being reduced in the Illinois coal fields by equipping the workers with "self-rescuers," tested and approved by the federal bureau of mines. They are designed to give the wearer half an hour or more after the gas surrounds him before he is overcome, and consist of a pinch clamp for the nostrils attached to a small can with a mouthpiece. The device is worn in the pocket or on the belt and is inclosed in a soft brass case that may be ripped open by hand. When the fumes arise, the breathing apparatus is quickly adjusted and by inhaling and exhaling through the mouth into the can, the miner is protected from the poison for at least half an hour and has a chance to seek escape.

¶On the Iguassu river in South America, 600 miles from Buenos Aires, there is a waterfall which is one-third higher than Niagara Falls.

Saxophone Played by Slotted Slide Instead of Holes and Keys

Sliding saxophones, operated on somewhat the same principle as the trombone,

Playing the Sliding Saxophone; Finger Ring for the Right Hand Helps the Action

have made their appearance in musical circles. Instead of the usual arrangement of holes and padded keys, this instrument has a closed tube at the side that moves up and down a groove to produce the different notes. The player is afforded a convenient hold on the slide by a ring through which the forefinger of the right hand is passed. Manufacturers of the article assert that it is more easily mastered than the usual saxophone, weighs considerably less and that it does not readily get out of order.

Cotton Made to Wear like Wool by Dipping in Acid

Cotton is said to be increased fifty per cent in strength and the resistance of the surface to scraping improved 200 per cent by immersing it in concentrated nitric acid under a process discovered by a Swiss scientist. The treatment causes the fibers to become rough and curly, resembling wool and having approximately the same wearing qualities. The acid gives the cotton a yellowish tinge but this is removed by bleaching and the effect of the chemical does not extend below the surface. The fabric may be mercerized later, that is, given a silklike sheen by dipping it in strong alkali, a method discovered seventy-five years ago by John Mercer, an English chemist. This wool-like cotton is said to dye more readily and brilliantly than the untreated fabric and when mercerized, closely resembles linen.

Fiber Sound Disks to Improve Phones Get Better with Age

Diaphragms for telephones, phonographs and loud speakers, are to be made from a composition of fiber, iron filings and bakelite according to a patented process which is said to result in material nearly resembling the human vocal cords in structure. The substance is more delicate than the metal now used for the sound disks and is claimed to give better effects as it becomes older. For talking machines and loud speakers, the composition diaphragms will remove much of the harsh metallic noises often heard through such apparatus, and, it is believed, will give a clearer reproduction of voices and some kinds of instrumental music.

Pocket Micrometer with Dial Face Is Easily Read and Operated

For measuring the thickness of various materials and small parts, a watch-shaped pocket micrometer, with a dial face an inch and a half in diameter that shows readings in half-thousandths of an inch, has been invented. It is held by one finger slipped through a ring on the side, and is operated by turning a knurled screw at the top between the thumb and forefinger to move the jaws below, between which the object to be measured is inserted. The gauge will record accurately sizes up to five-sixteenths of an inch, is said to be much easier to read and manipulate than the usual style of micrometer and is fitted in a bronze case so designed that it cannot spring and thus give false readings on the dial. On the reverse side of the gauge is a table which shows the decimal equivalents of common fractions.

Listening to the Football Returns through Loud Speakers Set in Niches on Bandstand

Bandstand Set with Loud Speakers Helps Relay Football Returns

Long after the summer concert season had closed, football enthusiasts thronged to the Common in Boston and gathered about the bandstand, where loud speakers had been set in niches near the roof, to hear returns of a game. The circular shape of the structure suited the purposes of broadcasting, enabling the crowds on all sides to hear. The horns were painted white and shaped to blend with the architecture of the stand, the half-hidden radio "oracles" adding to the appearance of the pavilion and extending its usefulness beyond the limits of the summer season.

Run Sidewalk through Building in Order to Widen Street

Running the sidewalk through the corner of a building solved a difficult street-widening problem in Ottawa, Canada, and added another traffic lane at the intersection, besides speeding up traffic by substituting an easy curve for the former right-angle turn. The corner of the building, a stone, steel and concrete structure, was altered by running the sidewalk within the building, behind the corner pier, the new wall line connecting the first pier from the corner on one side with the corresponding pier on the other. The ten-foot sidewalk was then rounded off around the building, the new curb line passing just outside the corner pier, allowing only enough curb line to protect the pier from being scraped by passing vehicle hubs. The city's plan commission, which worked

How Store Space Was Sacrificed for a Sidewalk to Solve Street-Widening Problem

out this arrangement, is contemplating similar treatment for other corners.

Portable Motor-Driven Handsaw Cuts Wood, Fiber or Metals

Driven by a small motor using 110 or 220-volt circuits, a portable handsaw with interchangeable blades for cutting different

Door Trimming and Other Exacting Jobs Are Easily and Accurately Done with Motor Saw

kinds of material, has been devised to save time and labor and reduce the cost of various carpentering and other jobs. Air cooling, shafts mounted on ball bearings and a body made of light aluminum alloy, make the saw durable, smooth in operation and easily handled. It can be used on wallboard, fiber or bakelite, and special cutters are provided for steel, brass and other metals.

High Chair, Cradle and Buggy in One Save Space in Home

Baby's high chair, buggy and a rocker cradle have been combined in one compact and easily manipulated article by a western manufacturing company to save the necessity of purchasing separate pieces and having them in the way when not in use. The rockers for the cradle serve as legs for the chair and as handles when the buggy is needed. The wheels are rubber-tired and can be swung up out of the way. A movable tray for food and a strap between it and the seat, are additional attachments on the chair for the comfort and safety of the infant. The article is sturdily constructed, can be changed in little time and is especially adapted to indoor use, though it is well suited to the street.

Cathedral Rises and Falls with Tide That Compresses Clay at Base

Owing to the tremendous weight of tide waters that enter the Thames river, the clay around the foundations beneath St. Paul's cathedral in London is said by engineers to be compressed, causing the building to rise during the flood periods. When the tide recedes the structure resumes its normal level. Similar effects of the ebb and flow of the ocean are reported to have been noticed in several piers of the Waterloo bridge, which rise about three-sixteenths of an inch every time the tide comes into the river.

Costly Animals as Zoo Attractions Less Popular than Cheaper Ones

Fifty-dollar monkeys and their antics, and birds that cost but a fraction of the $15,000 spent for a pair of pygmy hippopotami, are more popular with the zoo-going public than the expensive animals, according to Raymond L. Ditmars, cura-

Baby Can Eat at Table, Enjoy a Rocking and Take a Ride in This Combination Folding Outfit

tor of mammals and reptiles of the New York collection. Rare specimens may be precious to the scientist but the crowds give them a passing inspection that they may tarry longer where young orang-utans and monkeys gambol and birds display their brilliant plumage. People doubtless would be disappointed if the zoo did not have the larger and costlier creatures, Mr. Ditmars believes, but inexpensive sea lions and even lowly prairie dogs that can be bought for one dollar a pair, provide more amusement for the visitor than exhibits in which thousands of dollars have been invested. Most of the large mammals cost from $1,000 up. Giraffes, hippopotami and rhinoceroses bring around $7,000 each; elephants from $2,500 to $5,000; zebras from $1,000 to $1,800 and lions and tigers a few thousands each. Snakes, in spite of the general aversion to them, attract many and, as they are cheap to maintain, are considered a star exhibit.

Burlap "Bonnets" around Trees Aid Symmetrical Growth

West winds raise such havoc with shade trees planted in the civic center in San Francisco that burlap protectors are erected about them while they are young to prevent leaning to one side. Stout frames are constructed and anchored firmly in the ground and the fabric nailed between the crosspieces.

Windshields of Burlap Built around Young Trees in San Francisco's Civic Center to Keep Them from Growing Crooked

Fifth-Wheel Marker on Auto Truck Reduces Cost of Lining Roads

Time and labor required to put the center traffic line on highways are greatly reduced with the aid of a fifth-wheel marker attachment that fits any light motor truck. It is clamped to the running board on the driver's side where it may be easily seen. Paint for the line is supplied through a hose connection from a barrel and runs directly upon the felt-covered tire of the marking wheel, which rests against the cement. In front of the appliance are guides, a longer one for use on straight roads and a shorter one on curves, so that the old mark may be followed more easily.

Marking Center Line on Highway with Fifth-Wheel Truck and Paint from Barrel

Coal Is Tested with X-Ray Camera to Show How Much Ash It Holds

Another practical use for X-rays has been introduced by an English chemist who is reported to have devised a camera, which, with the aid of the rays, takes a stereoscopic photograph of the inside of a lump of coal, revealing the amount of ash-forming material it contains. This process, it is believed, will be of value in opening up new mines, as it will also show how much weight a sample will lose when the outer ash present is removed by washing.

Dictaphone Hooked to Radio "Cans" Programs for Further Use

When an especially pleasing musical number is announced for broadcasting from some station or a prominent person

Dictaphones in Position for Receiving Radio Programs, Showing Attachment to Loud Speaker Wire That Fits on Voice Tube

is about to deliver an important speech through the ether, a San Francisco inventor gets out his dictaphone, hooks it to his receiving set and preserves the programs for further enjoyment. The success of his method, he declares, lies in the way he has harmonized the radio voice vibrations with those of the dictaphone receiver. A pre-election speech of President Coolidge was recorded on two cylinders and is to be presented in this form to the chief executive by the inventor.

Mechanical Cashier Makes Change and Admits Persons to Trains

Patrons of an elevated railway in an eastern city have been testing a fare-collecting apparatus at the station gates installed to do the work of a human cashier. It automatically retains ten cents from a deposit of a quarter or a fifty-cent piece, returning the correct change and, at the same time, releasing the catch on the turnstile to permit entrance to the trains. Dimes—the regular fare—also are accepted, but the machine will not handle paper money, pennies or nickels. It is believed that the device will be of aid in rush hours as passengers with the exact fare, or coins which the contrivance will change, can pass through quickly.

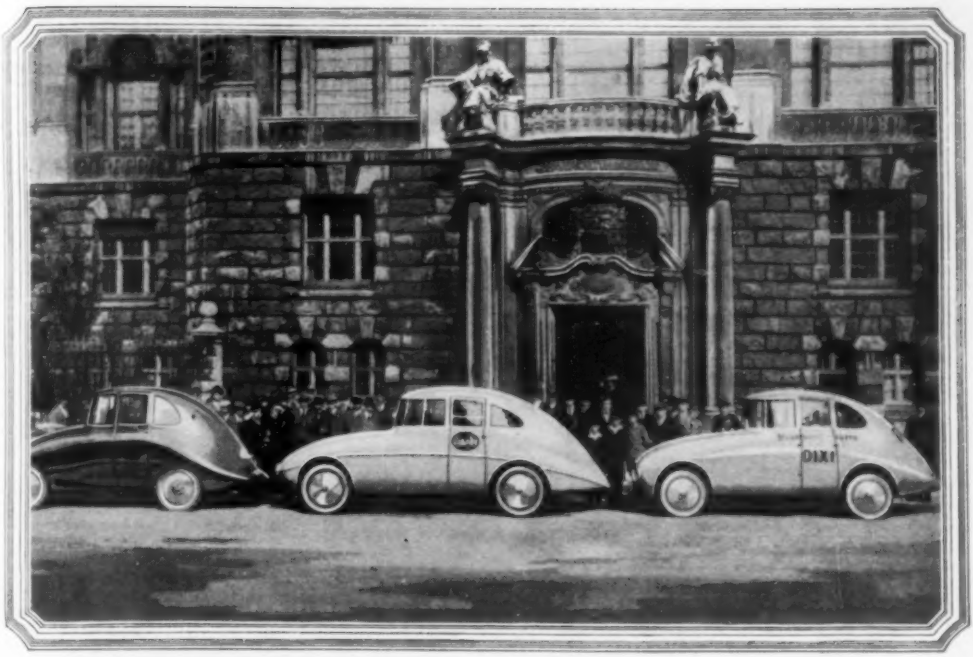
Pupils Are Taught to Imitate Birds in School for Training Whistlers

Whistling has been dignified into an art by a western woman who has started a school where pupils are given instruction in making the trills and calls of various birds with tongue and lips, and where concert and solo whistling is also taught. A special musical score, hardly recognizable to the layman because of its odd characters and wavy lines, is used and the bird notes have already been given special names such as "hewies," "whit-chas," "heedalas" and "lup-lups." The instructor declares that the vocal cords are not used at all in making these sounds, although she gives breathing exercises similar to those employed by students of singing. The founder of the school says that she learned to whistle by listening to the birds, and careful analysis of the tones has enabled her to reproduce them with realistic effect.

Glass Plate on Electric Wall Switch Saves Defacing Decorations

A glass plate for electric-light wall switches has been patented to replace metal escutcheons that often interfere with decoration schemes by hiding parts of the wall-paper designs. Scarcely visible, the glass variety permits any color plan to be carried out without presenting unattractive spots of metal surfaces. Unaffected by air or handling they do not require polishing or painting to remove tarnish spots, and only the button and two screw heads are visible when the plates are attached. The panels are also made in colored glass and with mirrored backs to correspond with various plans of decoration.

removed by washing.



Three Streamlined Cars, the Sixteen-Horsepower Ley, Thirty-Five-Horsepower Andi and Twenty-Four-Horsepower Dixi, in the Streets of Berlin

"Raindrop" Bodies for Automobiles

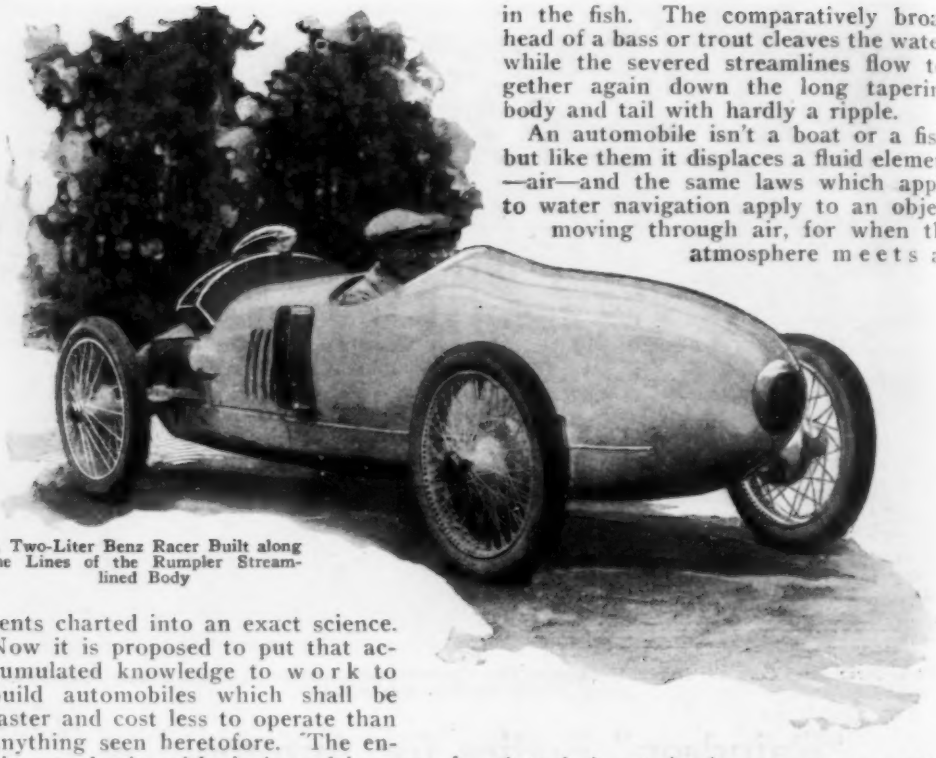
Scientific Streamlining Performs Wonders in Increased Power and Gasoline Saving through Decreased Wind Resistance

STREAMLINED automobile bodies, motors at the rear instead of under a front hood, and other radical changes are among the developments promised for the near future by both native and foreign automobile designers.

The "raindrop" body — completely streamlined to reduce air resistance to the lowest possible point—is already attracting considerable attention abroad and is being manufactured both in England and Germany. If the new school of design catches the popular fancy—and its proponents believe it will because the fully streamlined body is rational, they say—the motor car of the near future will at last escape from all vestige of the buggy and horse-drawn carriage motif.

Starting out with a one or two-cylinder engine built under an ordinary one-seated buggy, automobile builders became so firmly enmeshed in the tradition that they have never fully freed themselves of it. The first automobiles had buggy dashboards, buggy lamps, carriage wheels—and it wasn't much more than twenty years ago that one automobile designer put a car on the market equipped with a whip socket! The evolution of the automobile proceeded rapidly, but always with the impress of carriage builders' designs. The dashboard evolved into an instrument board and cowl, and a hood projected in front of it, to cover the engine, which in the early days was such an uncertain quantity that it must needs be placed at the point of greatest accessibility. Straight lines and alleged streamlines which paid little attention to streamline principles replaced the more elaborate curves and angles of family-carriage days, but the automobile still kept the same general contour laid down by the first builders who entered the new field.

In the meantime a new industry was rising to build airplanes, and for the first time exact studies were made of streamlines and wind resistances. Scientists were employed and wind tunnels constructed and the mysteries of the invisible air cur-



A Two-Liter Benz Racer Built along the Lines of the Rumpler Streamlined Body

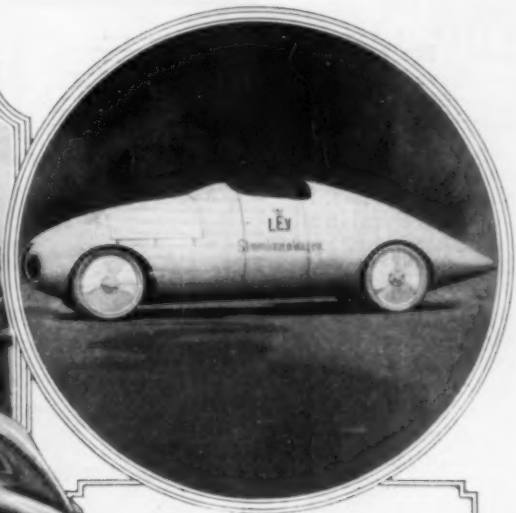
rents charted into an exact science. Now it is proposed to put that accumulated knowledge to work to build automobiles which shall be faster and cost less to operate than anything seen heretofore. The engine, to begin with, is in a fair way of being relegated to what is described as its natural position, over the rear axle. Modern motors do not require such constant attention as to make extreme accessibility necessary; the starter has displaced the crank, and, in short, the principal reasons for having the engine under a front hood are gone. Next, the falling raindrop is being reproduced in wood and steel, just as it was in wood and fabric for the airplane, and the result made into comfortable automobile bodies. The latest thing in streamlining is designed to eliminate not only the vacuum drag against the rear of a car, but the power-absorbing swirls in the air, which cut down speed and leave clouds of dust floating behind. The new bodies slip through the atmosphere with so little disturbance that the air currents slide back into place and the dust is hardly raised above the road.

The science of streamlining is founded on natural phenomena — the graceful curves produced in running water as it slips around a stick or other obstruction, for example. Most people have watched a stream as it is divided by a bridge pier or rock or perhaps a fixed snag, only to slip quietly together again. Nature likewise has produced a perfect streamlined body in the fish. The comparatively broad head of a bass or trout cleaves the water, while the severed streamlines flow together again down the long tapering body and tail with hardly a ripple.

An automobile isn't a boat or a fish, but like them it displaces a fluid element —air—and the same laws which apply to water navigation apply to an object moving through air, for when the atmosphere meets an obstacle it acts in the same way as water. It is true that air is nearly a thousand times less dense than water, but the surface presented by a motor car is almost a thousand times bigger than that offered by a fish, and a car moves at a much higher rate of speed, so that the reaction of the displaced air on an automobile in motion is proportionately much greater than that of water on a swimming fish. Wind-cutting shapes, "torpedo" bodies and boat-shaped designs for racing cars, have been used by automobile builders for several years, but the airplane wind-tunnel tests show that almost without exception they are scarcely more than a matter of fashion and hardly take into account the lines of least resistance. Bodies which seem to "cut the wind" actually offer practically the same air resistance as rectangular blocks, according to Jaray, one of the leading European designers, who for ten years has helped improve Zeppelin designs.

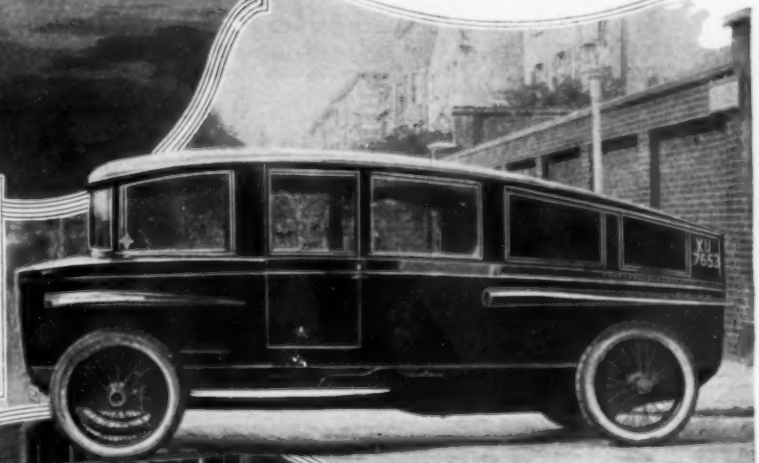
His investigations show the wind resistance of an ordinary car going at twenty-two miles an hour eats up sixty per cent more power than a streamlined body on the same chassis. At forty miles, the wind resistance increases the power consumption by ninety per cent, and at fifty the excess energy used because of resist-

boards, buggy lamps, carriage wheels— and the mysteries of the invisible air cur-



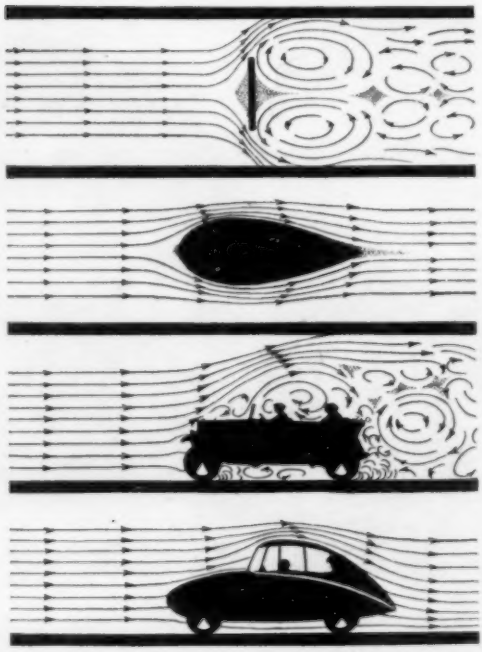
Ley Chassis, with the First Perfectly Streamlined Body Built by a German Aeronautical Engineer

Procession of Streamlined Cars Passing the Old Imperial Palace in Berlin, and Right, a "Raindrop" Car Designed by Doctor Rumpler, Creator of the Famous Taube Airplane



The Smooth Lines of the Jaray-Type Body, on an Andi Chassis, at Left, Run from Stem to Stern without a Break, While the Overhang Removes the Wind Resistance of the Wheels

ance of the atmosphere is 110 per cent. He concluded there was only one way to effectively streamline a car, and that was to inclose every part, even the wheels, in one streamlined body. Wind-tunnel experiments indicated that the greater volume of air displaced by a car should pass over it, while the air near the ground must remain horizontal, so as to stir up no dust. Eventually he worked out a shape which approximated the upper half of a dirigible, cut on a horizontal plane and placed as near the ground as possible. Actual tests showed wind resistances of one-quarter to one-third that of ordinary bodies. That means that when a sixteen-horsepower car is running at an average speed of twenty-two miles an hour, or when a forty-horsepower car is running at an average of thirty-one miles, a saving of close to thirty per cent in fuel is effected. At higher speeds the saving runs as much as forty, fifty per cent or more. The result is that the driver who slows down when passing through villages and towns, and then speeds up on open stretches to keep his average rate normal, actually saves more fuel than if he had maintained the average speed for the entire distance. Cars with the new bodies which have been operated in Berlin and London have attracted considerable attention because of the peculiar design, but the builders deny that the machines look "freakish." They rest their claims on the assertion that if nature had ever built a motor car she would have taken the same design they have adopted, to get the greatest efficiency.



Wind-Resistance Diagram; Top 100, Second Five, Third 100, and Bottom Twenty-Five Per Cent

Streamlined Bodies on Ley, Andi and Dixi Chassis Passing through the Famous Brandenburg Gate in Berlin

Rail Motor Cars for Passenger Use on One Hundred and Fifty Lines

Popularity of the gasoline and electric motor as an aid to the steam railroad is shown by a recent report issued by the National Bank of Commerce, stating that 157 lines were using motor coaches in the passenger service at the beginning of 1924, at a cost of from one-third to one-fourth of that of the regular equipment, and that trucks are being widely employed as "feeders" to the main lines. The chief service of these smaller vehicles is believed to lie in supplementing the steam trains. The report states that motor trucks are used mainly on the short hauls, a study in Connecticut showing that about thirty-seven per cent of the tonnage moved by gasoline carriers was hauled less than ten miles, thirty per cent more than ten and less than thirty miles, and only fourteen per cent more than seventy miles. As a solution of terminal congestion, the motor truck, by shortening the unloading and handling time of freight, releases many regular cars for long hauls. Surveys show that an average freight car occupies nearly fifteen days to the trip, but of this time, it is actually moving or delayed on the line in haul only a little over a day and a half.

Radio Aerials Not a Menace

The limited extent of radio aerials is declared by the bureau of standards to prevent them from becoming any more of a lightning menace than rain spouts, metal clotheslines or tin roofs. If provided with arresters or properly grounded, the report says, they may serve as effectually as lightning rods in draining the current from the air, but may become fused or torn from their fastenings by a direct stroke.

Picture on the Outside of Church Teaches Bible Lesson

Reversing the usual custom of decorating the interior walls with symbolic paintings, the rector of a church in Germany has had a large mural placed on the exterior where it may be plainly seen by members of the congregation and all who pass the doors. The work was done by a noted artist and depicts a scene from the Book of Revelation. A smooth surface and absence of obstructions in the gable of the building made the painter's task easier.

German Church with Its Exterior Mural Painting Depicting the Four Horsemen Mentioned in the Revelation of St. John

¶We want all our readers to write us freely and often whenever they wish additional information on articles published in this magazine. Address Bureau of Information, Popular Mechanics, Chicago.

Press Prints Many Colors at Once Using Paper Instead of Ink

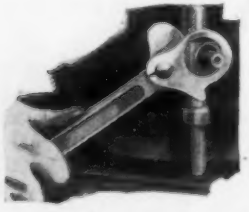
Show cards, signs, tickets and similar matter can be printed quickly and cheaply in several colors at a time on an ingenious press invented in England. It uses strips of colored paper instead of ink, impressing them into cardboard after the manner of an embossing machine.

Pressure on Lever Stamps Colored-Paper Letters in Place of Ink on Cardboard Sign

Loose gun-metal type is used and is forced against the stock by means of a lever capable of developing sufficient pressure with only slight effort from the operator. The outfit eliminates the need for typesetting frames and other equipment, reduces the cost of the job as only one impression is necessary to make as many colors as desired, and the finished sign is said to be more distinctive than an ordinary printed card as the letters stand out vividly against the background.

Wrench Worked with Single Hand Is Easily Adjusted

Telephone linemen, steel workers and others who often can use only one hand at a time, are supplied with a serviceable tool in a quickly adjusted spanner, or wrench, that fits tightly and has a wide range of usefulness. A ring jaw slips over the nut or pipe, closing automatically with the aid of a spring, and pressure is applied from the handle through a cam-shaped stub at the end. The tool can be placed in working position with only one hand, enabling the workman to hold on with the other if necessary. The head will fit almost any size nut up to its capacity, and other tools are not needed to supplement the wrench.



Dog Teams, "Autos" of the North, Travel Forty Miles a Day

What the motor car is to the macadamized road and the camel to the sands of the desert, the dog teams are to the frozen snows of the northlands, where these powerful animals for many years have been playing an important part in the development of regions whose extreme cold and lack of other transportation facilities restrict travel. Used largely to assist commercial enterprise and explorers, the dogs also help forward the interests of justice and order. The Royal Canadian mounted-police corps has 128 trained huskies in its service. A trained team can make forty miles a day and maintain this speed for days. Each is hitched to haul a load of about 125 pounds and, as a rule, teams are composed of from five to seven dogs.

Oxyacetylene Gas Tank Regulator Prevents Fires and Explosions

Pressure of oxygen and acetylene gas is said to be automatically regulated with an attachment for welding apparatus that has been devised to reduce the likelihood of fires and explosions. Both gases are controlled by a single wheel fitted with ball bearings for easy turning. Pressure readings for both tanks are plainly visible on the gauges of the instrument. In addition to greater safety, the device is said to produce a more efficient flame.

Insects Practice Arts Known to Man and Excel Him in Skill

That insects do almost everything known to mankind whom they excel in skill, is the belief of a well-known nature student, who spoke before a meeting of the American Institute of Phrenology. While the less developed species live under rocks or in the earth and exist by hunting, trapping and fishing for prey, others colonize in large communities and keep herds, raise crops and use leaves for clothing and shelter. Many insects even build tiny streets and highways, tunneling

and bridging where necessary, to aid them in their travel. Various systems of government resembling those of man have been observed among them, and wars are carried on between tribes in which every art of attack and defense employed by modern militarists is practiced. Poisonous liquids, gases and powders serve as ammunition in addition to small bulletlike projectiles that identify several of the more warlike specimens. To escape observation by their enemies, the individuals of some types resort to disguise and camouflage. For rapid travel, some construct aerial carriers on which they sail through the air while others build small floats to traverse water. Aquatic bugs have been found which use a sort of submarine boat to penetrate beneath the surface. The speaker also stated that man has learned the art of making perfume from the insect world.

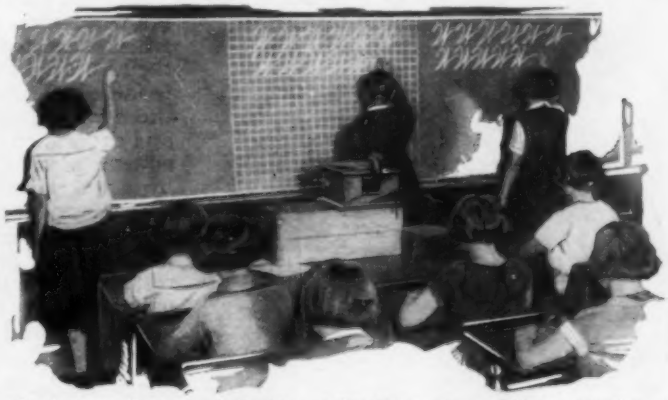
Air-Filled Upholstery for Autos Gives Greater Comfort

Pneumatic tubes are being made to fill automobile cushions in place of springs, pads and other built-up upholstery. The tubes can be quickly blown up by an ordinary hand pump or deflated and removed when not required. Designed so they can be folded to the shape of the cover and present an even surface, the tubes are claimed to eliminate all jars and shocks to passengers caused by the road or engine. Because they need but very low air pressure, they afford soft, comfortable seats and reduce wear on the coverings.

Auto-Seat Cushion Filled with Pneumatic Upholstery Which Folds into Smooth, Springy Padding

Writing to Fox-Trot Record Improves Penmanship

Pupils in penmanship at a New York school are said to be greatly aided in acquiring legible and graceful handwriting by the rhythm of fox-trot and other dance records played on a phonograph in the class room. The beat of the music and its regular cadence help in making smooth and properly formed curves as the hand naturally keeps time to the selection and the writers are encouraged to do more work than they would if left to their own devices. Correct strokes are demonstrated by pupils at the blackboard for the benefit of those at their desks.



Students at Desks and Blackboard Practicing Penmanship to Rhythm of Dance Record Phonograph Is Playing on Teacher's Desk

Shining Tower of David Discovered among Ruins in Palestine

Ruins that are believed to have been the walls and buildings of the city of David, have been discovered after extensive excavations in Palestine under the direction of J. Garrow Duncan. The original Jebusite wall of the fort, which was standing when David took it in the year 1000 B.C., has been traced, it is claimed, and the gleaming white-limestone surface of a magnificent tower has been exposed to the light of day and is now visible from all parts of the city. The discovery apparently settles disputes as to the location of the city, and seems to prove that the site has been continuously occupied for over 5,000 years, as some of the pottery unearthed at Ophel near by is said to belong to the cave-dwelling period of 3000 B.C. and earlier. The Palestine government has set the wall apart as a national monument, and the tower is being restored.

Bicycle Converted into Key Factory Nets War Veteran Profits

About the only asset a Detroit man had after four years' service with the Canadian forces during the World War was a bi-

Bicycle-Power Key Factory and Veteran Operator with His Sign and Samples of His Wares

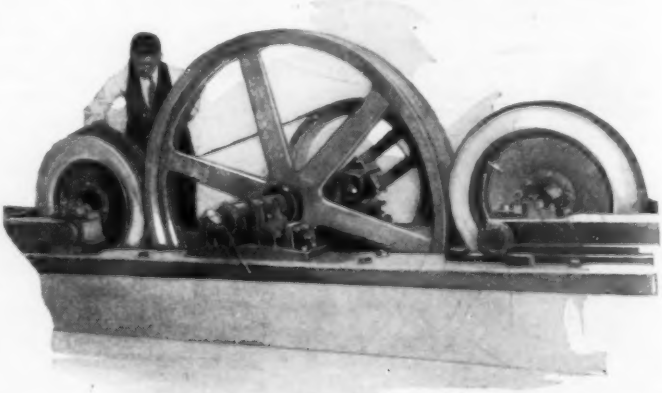
cycle. Applying his skill as a tinker, he rigged a series of emery wheels and circular files to the sprockets, rented space between two doorways on a busy street and established himself in the key-making and knife-sharpening business. By elevating the rear wheel and sitting in the usual riding position, he was able to pedal the gears and grinders with sufficient speed to make a key from a blank in about a minute and sharpen knives and scissors while the customers waited. Shifting the chains and lowering the wheels fits the bicycle for riding home at night, and the trip to work in the morning is taken in the same way. The veteran says he averages about 200 keys a day and estimates that he has pedaled the equivalent of a 100,000-mile journey in the last five years while operating his unique shop. On busy days, receipts from the factory total $50 and more.

Rogues' Gallery of Handwriting Helps Identify Lawbreakers

By means of a file of handwriting specimens of known criminals, the police of Berlin are able to identify many lawbreakers who might otherwise escape detection when suspected of evil deeds. Samples of their writing are taken from convicted offenders, persons under suspicion, and those whose signatures have been forged, and experts compare these with the recorded examples. Burglary evidence is sought by a special squad of detectives whose processes of study are similar to those employed in gathering data for murder cases. Fingerprints are taken of all those arrested for crimes and impressions of the palms of the criminals' hands are also filed away for future use.

Man-Made Bumps Test Auto Tires and Foretell Wearing Qualities

Automobile tires sent to the bureau of standards for examination, among other tests, are given a long, bumpy journey against a rough-rimmed wheel to determine their wearing qualities. Two tires are tested simultaneously. They are inflated to regular running pressure and bolstered up against the big center wheel until the approximate weight they carry on the road is obtained. Then the tester is started, and as it revolves, the tires thud over obstructions placed on the rim to represent street and pavement bumps. In less than four days of this stationary running, the inspectors, by carefully measuring the wear of the tires, can tell how long the rubber will last under service.



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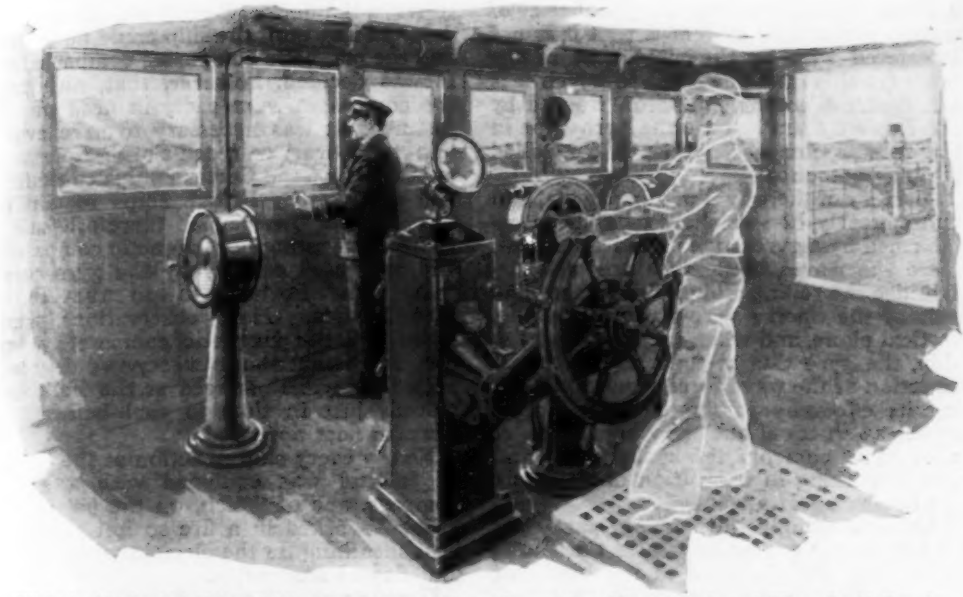
Bumps on the Big Center Wheel Wear the Two Auto Tires as Though They Were in Service



With the Mechanical Helm Holding the Ship to a Truer Course than Most Experienced Pilots Could Do, the Coxswain Is Relieved to Keep a Sharper Watch along the Route

How the Gyro Makes the Earth Work

Spinning Wheels Help Man to Cross Seas, Defy Elements and Conquer Nature

THE child who watches a spinning top may not know that his rotating toy obeys a fundamental law of the universe which binds the turning earth to the sun and rules the motion of other universes within the confines of the star dome.

But if the theory of modern scientists is correct, the movements even of electrons in infinitely small particles of matter are gyroscopic rotations much like those of the planets in their orbits round the sun. Light, too, is thrown on other terrestrial riddles. The gyroscope is a rotating wheel, which, when turning on an axle allowing it to move freely in several directions, resists attempts to change the direction of its axis or spin. Its peculiar powers will cause a train to run at high speed on one rail across a gulf bridged by a steel-rope rail; stabilize a rolling ship in a heavy sea; guide the sailor and aviator in fog and darkness; help the gunner on the turret of a modern battleship to train his ordnance on an elusive target. The true type of the gyroscope is the earth which has been rotating on its axis ever since it was thrown off the sun countless ages ago.

When Columbus sailed for the new world, he carried a magnetic compass which fairly accurately pointed to the magnetic north; but, today, the battleship or the liner, built of huge masses of steel and iron, cannot rely altogether on its magnetic compass which is liable to deviation caused by the influence of the earth's magnetic field on the iron of the moving ship. The modern navigator therefore calls to his aid the gyro-compass. This wonderful instrument is an application of the fact that a spinning gyroscope to which a weight is hung, will, under the combined influences of gravity and the rotation of the earth, point to the geographic north-south, and turn in the same direction as the earth.

Today, every officer who aspires to promotion in the American and British navies and mercantile marines has to keep abreast of gyro-compass developments, and especially of that invented by Elmer A. Sperry, and first installed on the U. S. S. "Delaware." The nerve center of the Sperry gyro-compass is a master compass, placed near the ship's center line where rolling is felt the least. Essentially, it is

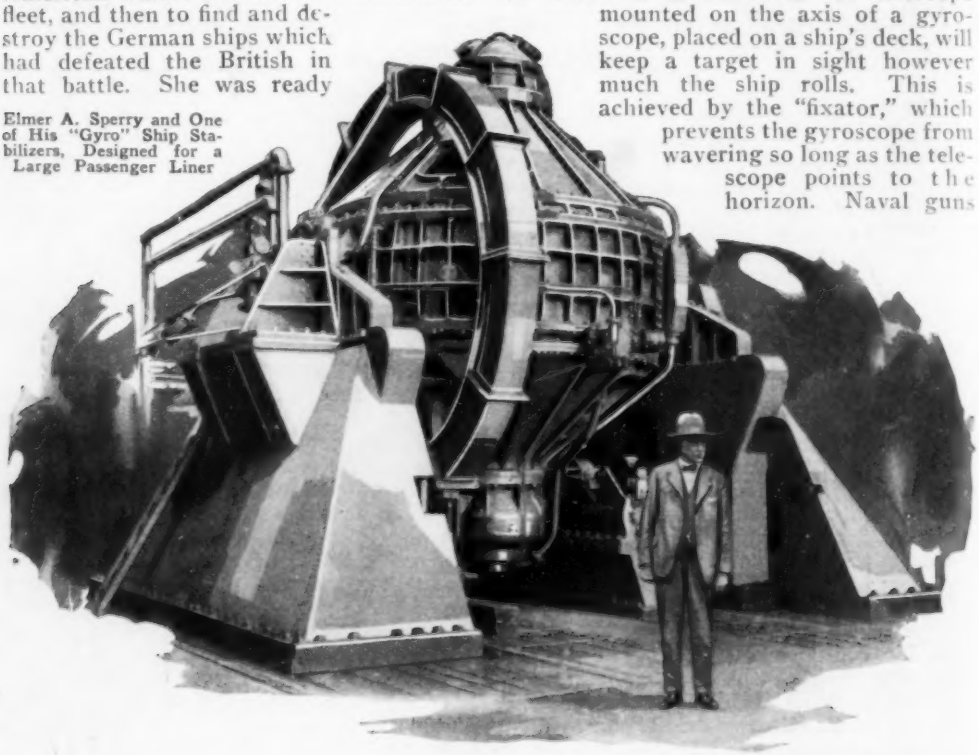
a three-frame gyroscope, the peculiarity of whose mechanical system is that it is not interfered with by the movement of the body (in this case, the ship) to which it is attached. A motor generator, worked by the ship's dynamos, runs the gyroscope in the master compass, which is controlled from a switchboard.

Mastery of the waves of a heavy sea, and consequently of seasickness, has been established by a gyroscope placed amidships. Here the waves themselves are made to stabilize the rolling and pitching ship. The axis of the Sperry gyro-stabilizer is in a vertical plane, and when the waves hit the ship, the gyro tilts at right angles to the direction of the wave force, thus neutralizing its effect by passing it out at right angles as an equal but opposing force. A pilot gyro controls the main gyro, and sets it working in opposition immediately the beginning of a roll is felt.

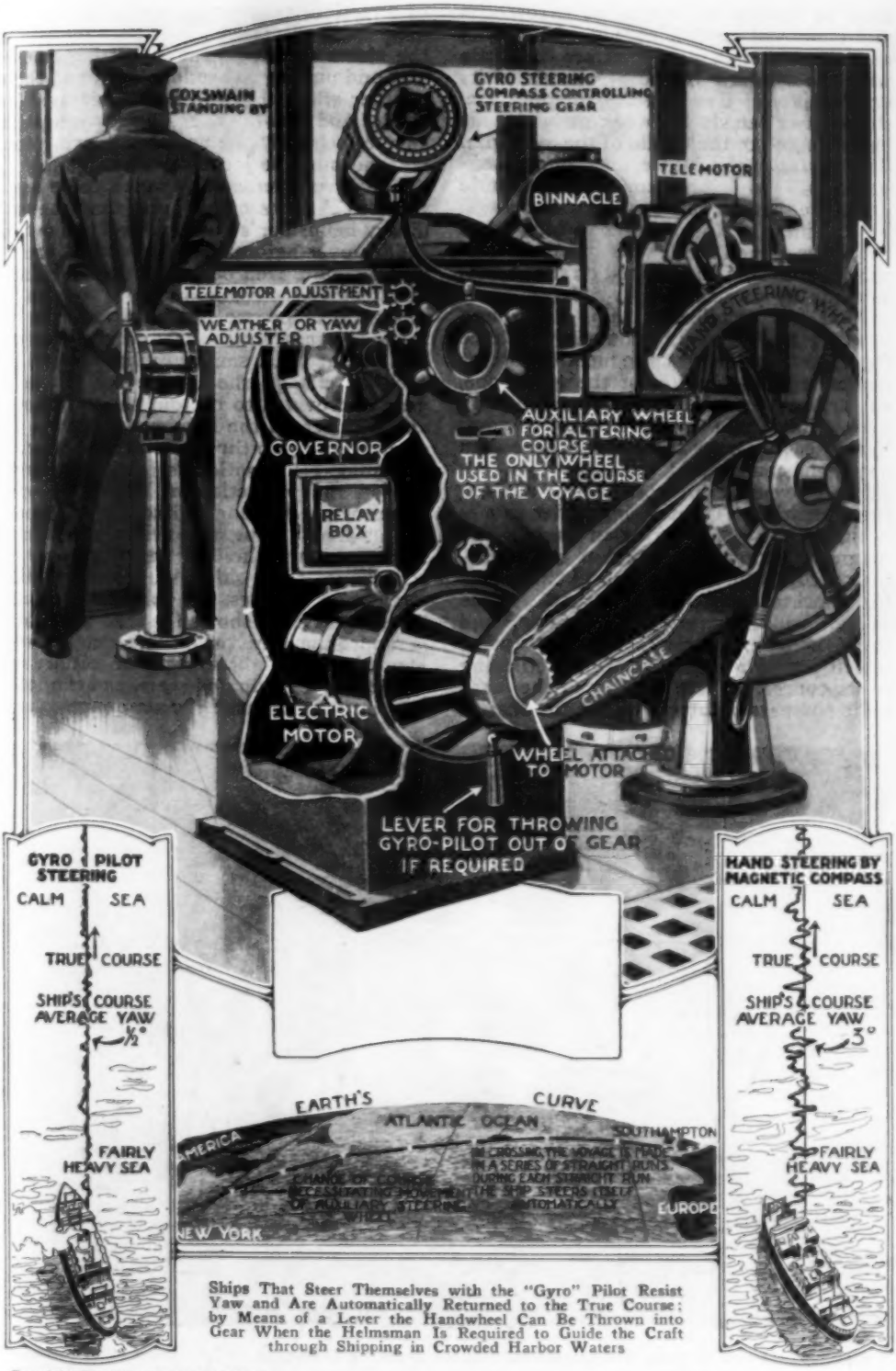
An exceedingly interesting part was played by the gyro-compass in the European war. At the time of the battle of Coronel on the west coast of South America, the British battleship "Invincible" was being overhauled at Portsmouth dockyard in England. She was immediately ordered with one other large British ship to South American waters to reinforce the British fleet, and then to find and destroy the German ships which had defeated the British in that battle. She was ready to leave the docks when it was planned to delay sailing until the ship could be swung and the magnetic compasses compensated. It was decided, however, that, although the compasses were badly in need of adjustment, it was necessary to save every minute in order to reach South American waters before the German ships could find and destroy the British ships remaining there. The "Invincible" therefore sailed without adjusting her magnetic compasses and navigated entirely by the gyro-compass from Portsmouth to the Falkland Islands. Here observations were taken and the magnetic compasses were found to be out about twenty-two degrees. The "Invincible" arrived at the Falkland Islands just in time to coal before the German fleet appeared.

Nearly every ship in action at the battle of Jutland was equipped with a gyro-compass, one of which, on the battleship "Lion," worked in a fire so hot that the lead sheathing on the electric cables fused and flowed like water.

Gyroscopes will also show a ship's captain whether he is moving on a straight-line or curved course. A two-frame gyroscope is here used, because such an instrument moves in unison with the body to which it is attached. A telescope mounted on the axis of a gyroscope, placed on a ship's deck, will keep a target in sight however much the ship rolls. This is achieved by the "fixator," which prevents the gyroscope from wavering so long as the telescope points to the horizon. Naval guns



Elmer A. Sperry and One of His "Gyro" Ship Stabilizers, Designed for a Large Passenger Liner



Ships That Steer Themselves with the "Gyro" Pilot Resist Yaw and Are Automatically Returned to the True Course; by Means of a Lever the Handwheel Can Be Thrown into Gear When the Helmsman Is Required to Guide the Craft through Shipping in Crowded Harbor Waters

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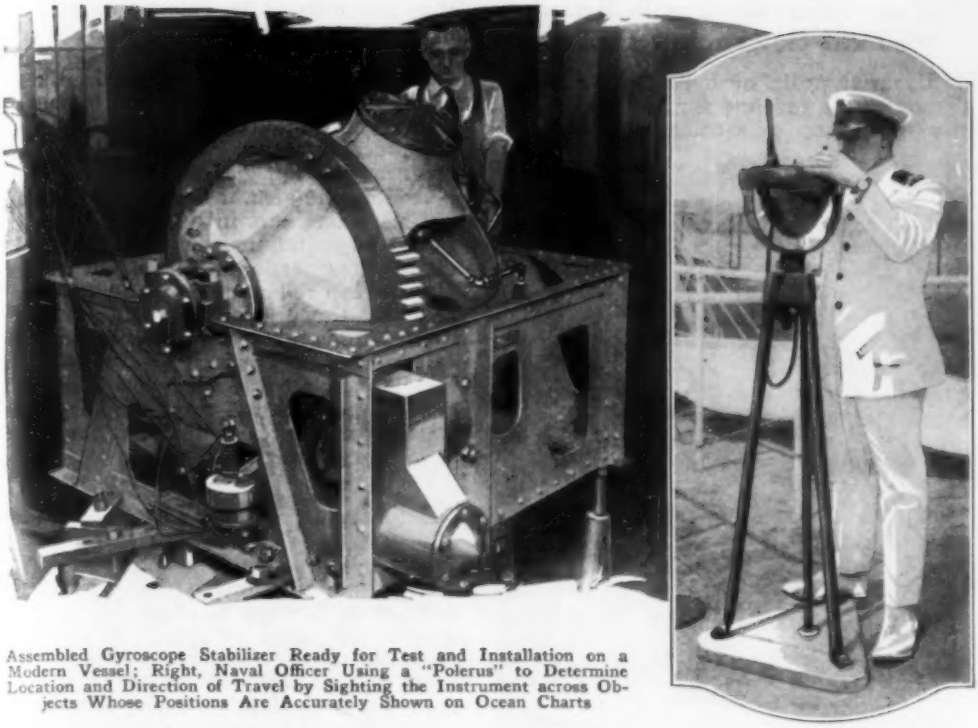
may be trained by means of gyroscopes and stabilized against rolling. The firing and recoil of such guns interfere very little with the spinning of the gyroscope on its cradle pivots. Even on the roughest sea, the gunner can do his work quietly if his chair is fixed to the cradle of the gyro gun. The navies of the future, according to experts, will no longer consist of gigantic dreadnaughts. Their vast iron bulks will be modified by the gyroscope into small ships weaponed with the heaviest ordnance, stabilized and trained on the roughest seas by these swiftly revolving disks.

Next to stabilizing ships in rough weather and furnishing compass guidance for them over the seas, the most important commercial application of the gyroscope, so far, has been in the automatic steersman, which can guide a ship through heavy seas on a far straighter course than any helmsman could possibly steer. A ship's movement in cross seas is exceedingly erratic. The buffeting water causes a big vessel to slew off at an angle. The magnetic compass in front of the steersman records the change, and he then spins his wheel to bring the vessel back. All the operations, however, require time, and there is an appreciable interval during which the ship is falling off or returning to its course. There is a lag in the magnetic compass before it records the change of direction, another lag while the steersman spins his wheel, still another while the steam steering gear is getting under way and putting the rudder over, and then another while the ship fights against the rudder and slowly swings back toward its course. Usually the vessel will swing too far, and must be jockeyed back again.

The gyro steersman is much more sensitive to changes of direction than the ordinary helmsman's eyes and will move the rudder over before the man with a handwheel would even be aware that the ship had changed direction. Once set on a straightaway course, it does not need to be touched again until a change in direction is necessary. A small auxiliary wheel is used to change the course set, while a gear is provided to cut out the gyroscope and connect up the handwheel for use in steering the ship through harbor traffic.

Commercial aviation is largely dependent on the perfection of the gyroscope. When white fog comes like a ghost upon sea or land hiding the aviator's beacons and landmarks, he has the "gyro-orthoscope" to show him whether he flies straight or swerves. A pointer on a dial, standing at zero, shows that the aeroplane is approximately on a straight course. Deviations of flight to right or left are indicated on a graduated scale, and the least angular movement of the aeroplane causes

Class of Engineers, in Study of Gyroscope Instruments, Receiving Instruction in Installation and Operation of the Devices as Stabilizers and Truing Implements on Ships and Aircraft



Assembled Gyroscope Stabilizer Ready for Test and Installation on a Modern Vessel; Right, Naval Officer Using a "Polerus" to Determine Location and Direction of Travel by Sighting the Instrument across Objects Whose Positions Are Accurately Shown on Ocean Charts

corresponding movements of the gyroscope. The railroads of the future also may be very different from those we know today. A citizen of a great city, fifty years hence, may look up into the sky and see a train running at high speed, not on two rails along costly viaducts and permanent ways, but on a single rail, or even a steel rope spanning the gulfs of air between the skyscrapers.

In this transformation, mechanism such as that perfected in 1924 by a distinguished Russian engineer, may play a great part. He has invented a monorail car which is a single gyroscope mounted on a vertical axle, and rotating vertically. Dynamos and motors supply the power rotating the gyroscope. It can also be made to rotate horizontally about a horizontal axis. Pendulums, on each side, come into action if the car leans. They cause a ratchet to engage with a rotating cogwheel attached to the gyroscope's axle, and to restore the equilibrium of the car by hurrying the precession or return to the vertical position of the gyroscope's axle. Special devices are used for easily rounding sharp curves, and for maintaining equilibrium. The monorail system halves the length and weight of sleepers, and permits a speed of 120 miles an hour. Giant cars have been designed, for main-line and suburban railroad traffic, capable of carrying 400 people.

Gyro-railways would be useful in hilly districts, since heavy embankments would not be required, and the cars, carrying double-flanged wheels can ascend gradients of one in eight as against a maximum of one in twenty on the ordinary railroad. As the car rounds a curve, an orthoscope comes into play, the axle of which is connected to a valve controlling a compressed-air system. The compressed air enters pneumatic cylinders and restores the equilibrium of the gyroscope.

In 1921 the construction of twenty miles of a gyro-railroad, for the Russian government, between Tsarskoe Selo and Petrograd was begun. Seven miles of this mono-railway track were laid, when difficulties of finance and rolling stock temporarily put a stop to the project.

How many thousands of lives and millions of property might be saved, yearly, if there were some means of foretelling the course of cyclones and hurricanes! An American meteorologist points out that cyclones, which are rotating masses of air whirling in the same direction as the earth's surface, possess gyroscopic properties. Some day this fact may be applied to the prediction of their paths.

Post Offices Used as Billboards Yield Government Profits

Bavarian postal authorities have devised a source of revenue for the department by setting up post-office kiosks of odd

Copyright, Keystone View Co.

Odd-Shaped Bavarian Post-Office Substation Plastered with Gaily Colored Advertising Signs

shape in the public parks and renting the exterior walls as billboards. The sides of the structures are arranged to form forty or more narrow panels, and in each of these is placed a highly colored poster advertising commercial wares. The plan helps to attract the public to the offices and places the signs where they are seen by hundreds of persons daily.

Real Rubies Can Be Told from False by Shape of Bubbles They Hold

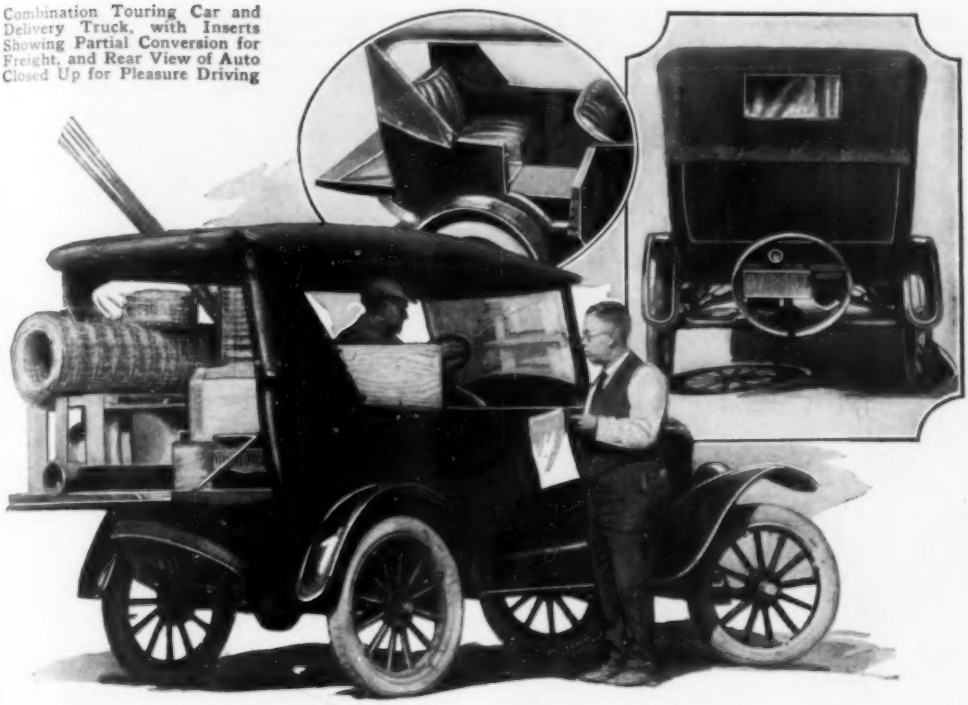
Rubies, like diamonds, have been widely imitated, but by a few simple tests, the genuine can be distinguished from the artificial with comparatively little trouble. A real ruby contains irregularly shaped bubbles, while those in the imitation are perfectly round, according to expert gem testers. The natural jewels also have a silky sheen due to a number of tiny parallel lines in their structure, a characteristic false specimens do not possess, and they are four times heavier than water so that it is not difficult to detect imitations of light weight. Genuine rubies are a crystalline form of a mineral called corundum and the best ones are mined in Burma. Thousands of tons of soil must be dug up, washed and minutely examined to collect the precious stones. Strong lights, powerful magnifying glasses and drops of oil placed on the gem, if it is in a setting, assist the examiners in detecting imperfections and imitations. Artificial rubies include those made of "paste" or colored glass, cheap red stones of little value that resemble the precious article, and imitation corundum manufactured by a chemical process. Flaws and blemishes in the real stones are the clues by which the genuine gems are distinguished from the false, but the fewer imperfections they have, the greater their value.

Card Index That "Thinks" Saves Work of Many Clerks

Saving of time and a reduction in the number of files are claimed for an index system for large or small offices. By means of slots in the cards and small steel rods, information may be obtained from the records by simply turning the cabinet upside down. The slots allow only those cards which are wanted to fall out of alinement. The rest are held in place by rods passed through holes. Those that are to be studied are then kept in an accessible position until it is desired to return them. Various combinations of data may be arranged and with the slots put in corresponding positions, the same file can be

Even a Child Can Insert the Rods for Releasing a Selection of Cards from File

made to serve a number of purposes. The cards are easily perforated on a hand punch, and the outside of the drawer contains the key to the system of holes and slots, so that the rods may be inserted in the proper places.



Combination Touring Car and Delivery Truck, with Inserts Showing Partial Conversion for Freight, and Rear View of Auto Closed Up for Pleasure Driving

Touring Car and Delivery Truck Has Seats That Fold on Floor

Combining a pleasure car and a delivery truck, an automobile body has been built with rear seats that fold on the floor and a back which can be opened out as a tailgate. Change from one type to another can be accomplished in a few minutes without injuring the upholstery. When but part of the vehicle is needed for freight, half the seat may be closed up, leaving room for one passenger in the rear compartment. For emergency deliveries, the body can be pressed into instant service and restored for pleasure driving after the load has been removed. Camping equipment and provisions can be carried for overland journeys and the car used for touring trips when stops are made.

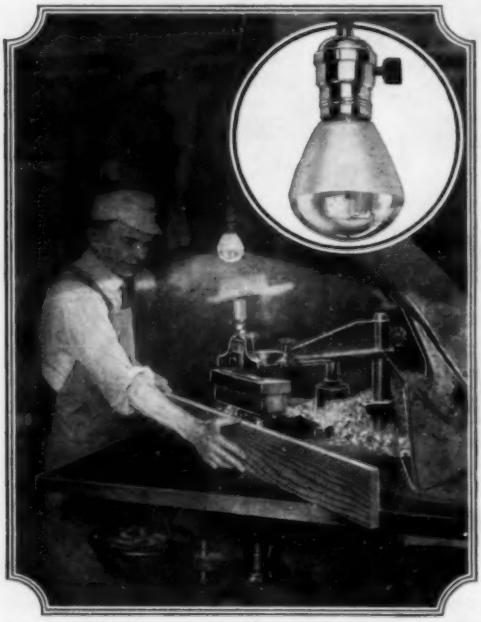
Mufflers Wrecked by Gas Blast to Test Their Value

To determine whether automobile mufflers will withstand the gas explosions to which they are subjected, the underwriters' laboratories have developed an apparatus by which a muffler can be blown up, to determine just how much pressure it will resist. The device to be tested is connected to an exhaust pipe which projects through the wall into an outside chamber lined with heavy steel screens to stop flying parts of metal. The engine is turned over with the starter until the exhaust pipe and muffler have been sucked full of vaporized gasoline. Then, the charge is exploded by means of a spark plug and blasts of varying degrees of intensity are repeated until the muffler is blown to pieces. The interest of the underwriters lies in determining the fire danger, and the results of the tests are used by insurance companies in fixing fire-insurance premiums on cars. The laboratories' automotive-testing department is equipped with a six and a four-cylinder engine, mounted on test blocks with a single instrument board, provided with recording gauges for gas, water and oil, and revolution indicators, while each engine also has a brake-horsepower indicator, which can be used not only to register the power developed, but also to put any desired load on the motor. The friction is so great, when the engines are loaded by applying the braking device, that a water connection is provided to cool the braking flywheel.

¶Ants identify their enemies and friends by the sense of smell, experiments have shown.

Reflector Coating on Electric Bulb Stops Glare and Focuses Light

Electric bulbs for a wide variety of uses, carrying their own shades in a reflector



Lighted Reflector Bulb Directing Glow upon Workbench, and Detail Showing Globe Coating

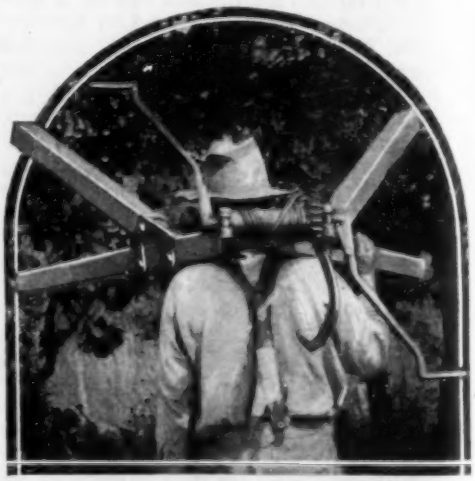
coating part way down the glass, have been placed on the market. Glare is prevented by them and seventy per cent of the light directed downward through the clear section without a shade attachment. They are, therefore, particularly suited for installation over machines where extra illumination is needed, for drop lamps to be used about the shop or garage, and for reading lights, it is claimed.

Sound of Electrons Heard by Radio in Vacuum-Tube Amplifier

By means of the radio vacuum-tube amplifier, scientists have been able to hear the noises made by electrons, the infinitely small units of electricity as they are "bombarded" against the plate in the tube from the hot filament. These electrons, it is held, carry the current and make possible the operation of the tube, which is capable of tremendous amplification. Through this, a new way of measuring the value of the electron charge has been developed, and a method of research opened which may lead to valuable knowledge concerning the electron and its properties. Previously, it has been studied by means of tiny drops of oil, observing their movements between two electrically charged plates. Droplets are made to fall slowly or rapidly or are held stationary between the plates, according to the presence of charged electrons in them and the voltage applied to the plates. With proper amplification, the roar of the electrons in the tube can be magnified to produce a volume like that of Niagara, it is said, and this action is to be studied in the hope that facts not presented in the gravity tests will be learned.

Portable Crane, Built like Sawhorse, Saves Farmer Time and Labor

Pulling stumps or posts, holding hogs in the air after they have been slaughtered, stretching wire and doing many other farm tasks may be simplified greatly with the aid of a portable crane invented by a Texas man. It is constructed somewhat like a sawhorse, and, in fact, may be used for sawing wood when necessary. A center crosspiece, used as the winding drum, is provided with two cranks, one at each end, and a steel cable with grappling tongs. With little difficulty, the apparatus may be adjusted for hoisting objects such as wagon boxes, pulling horses or cattle out of bog holes or for dragging telephone poles. The lifting power of an average man is said to be multiplied seven



Sawhorse Crane with Its Two Handles Is Carried About Easily on the Shoulders

times with this outfit although the entire equipment may easily be carried about on the shoulders.

Skilled Artists Complete Every Detail of Proposed Outdoor "Ads" in Miniatures Which Serve as Guides and Models for Sign Painters Who Accurately Produce Enlargements of the Designs

Recruiting Art for Outdoor Advertising

Millions Spent Each Year for Ornamental Trade Messages That Speak with Picture and Story along Nation's Highways

INSTEAD of daubing merchants' ads on fence boards, barn sides, and coarse walls that once might have offered a suitable surface for the lurid colors of the itinerant sign painter, the industry of outdoor advertising now devotes almost $100,000,000 a year to artistically designed panels and huge ornamental frames printed or painted with works of skill and beauty.

Accomplished artists who specialize in originating attractive subjects for their brushes create the pictured messages in miniature form which are first treated to a series of tests for their value in luring the eyes of the millions of travelers they are designed to reach with their stories. Crews of sign painters are constantly kept at work transferring these originals, enlarged to many times their size, to bulletin boards and illuminated panels erected at vantage points throughout the country. Where paper posters are to be used, lithographers print gigantic sheets on which the paintings are faithfully reproduced. Each sheet carries a section of the design, and these are finally assembled in proper order by the poster who places them on the outdoor boards.

So popular has the outdoor display method become in the past thirty years, that there is now hardly a country road or city avenue which has not been studded with colorful signs, many of them brilliantly illuminated by a blaze of electric lights at night. A corps of expert judges of locations are at work in various parts of the nation seeking new positions for the permanent boards, studying traffic volumes over boulevards, and measuring distances between highways and prominent points that afford suitable settings for outdoor advertising surfaces.

In the old days, when a paste pot, or paint bucket, and brush were the sole tools of the poster's trade, verbal permission from the owner of a plot of ground or abandoned barn was sufficient to establish

the worker's right to the desired space. Often a rival, disdaining priority, might erase the results within a few days and apply other sheets or lettered signs, to be followed by others who in their turn would make similar substitutions. But today the great sign-posting and painting concerns enter into thousands of contracts for space and position rights every year, paying a specified rental for the privileges to locations whose value as advertising mediums sometimes brings several thousands of dollars annually to the owners.

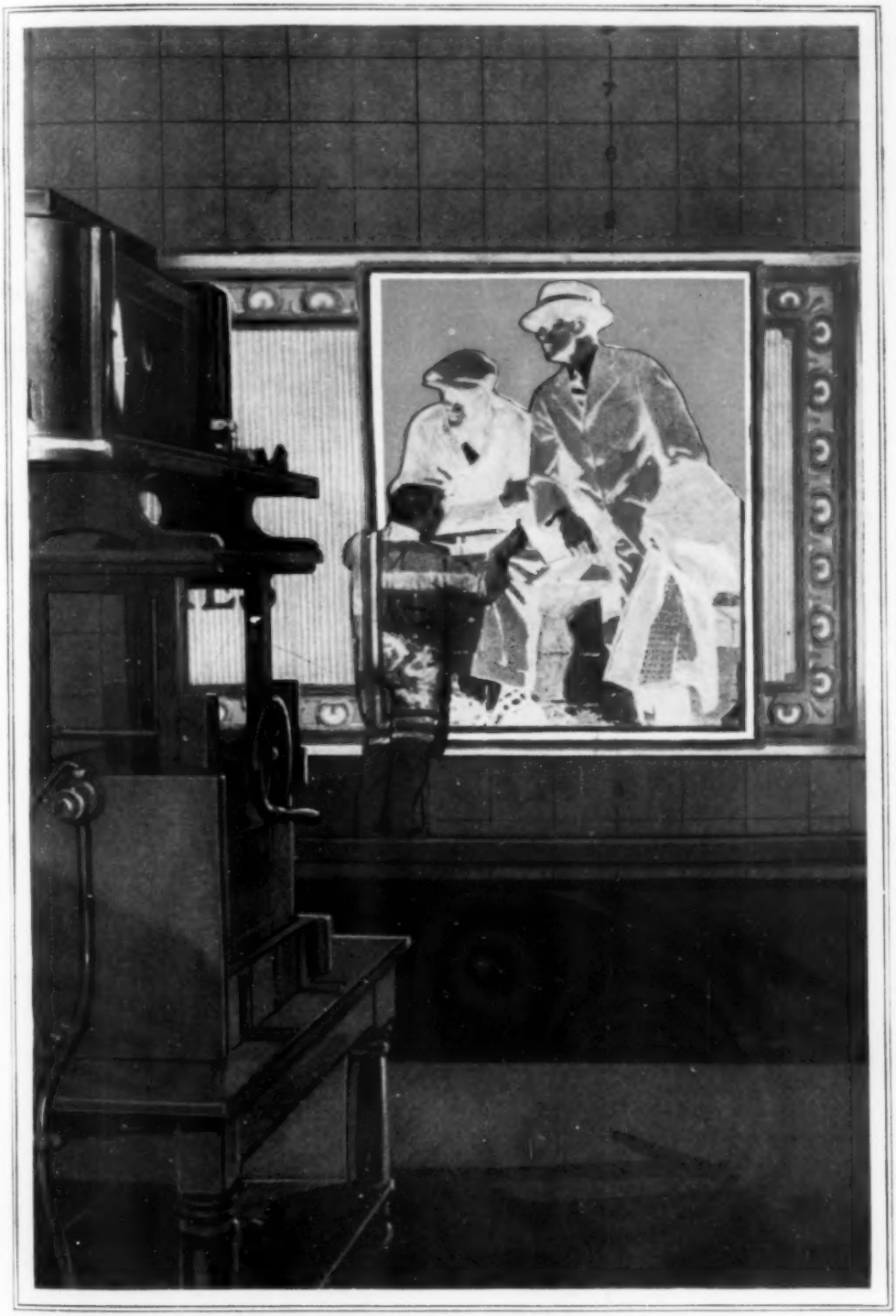
With the increasing use of electricity, an organization of electricians, skilled in the wiring and mechanical equipment of outdoor displays, is necessary for almost every posting company. Elaborate arrangements of lighting are designed to automatically switch on and off at proper times of the day and night. Often devices are introduced to control a series of floodlights which change regularly, adding greatly to the attractiveness of the sign.

Until recently, most of the huge boards which carried the advertising were constructed of wood, but now the surfaces are made of sheet metal and in many cases are prepared to take either painted designs or pasted paper sheets. Others designed and painted complete in the workshops of the posters are constructed of metal sections and transported to the scenes of display for assembling.

When an artist has finished the original design for an outdoor advertisement, the picture or model is photographed. From this a plate is made for inserting into a projecting machine which throws the image against a large wall marked off in thinly lined squares. This scale aids the workers to conform the completed design to the dimensions of the boards it is to cover. Sheets of pounce paper are then placed against the wall and the image is traced with a perforating device which outlines each figure and letter perfectly, to guide the artists who produce the enlarged pattern. All sections of the marked paper are numbered to indicate their positions in the

Tracing and Coloring the Picture and Adding Finish to the Design

Courtesy of Cusack



From a Plate in the Projecting Machine the Enlarged Image of the Picture Is Thrown on a Scaled Wall Where It Is Copied in Perforated Tracing on a Paper Pattern Sheet

finished design when it is finally transferred to the permanent surface. Piece by piece, the subject is accurately outlined on the board, and the artists place the colors in an exact but enlarged duplication of the original painting, following in every detail the small model.

To change positions as the painting progresses, the artists are provided with a rolling scaffold which can be moved with little effort, making repeated descent from its raised platform unnecessary. As each section of the metal sign is completed, it is removed from the supports and allowed to dry, after which it is coated with a covering of weather-resisting varnish. When the whole layout is finished, the set of metal pieces is transported to the location where they are fitted into the framework of the bulletin board to remain during the period of the advertising program.

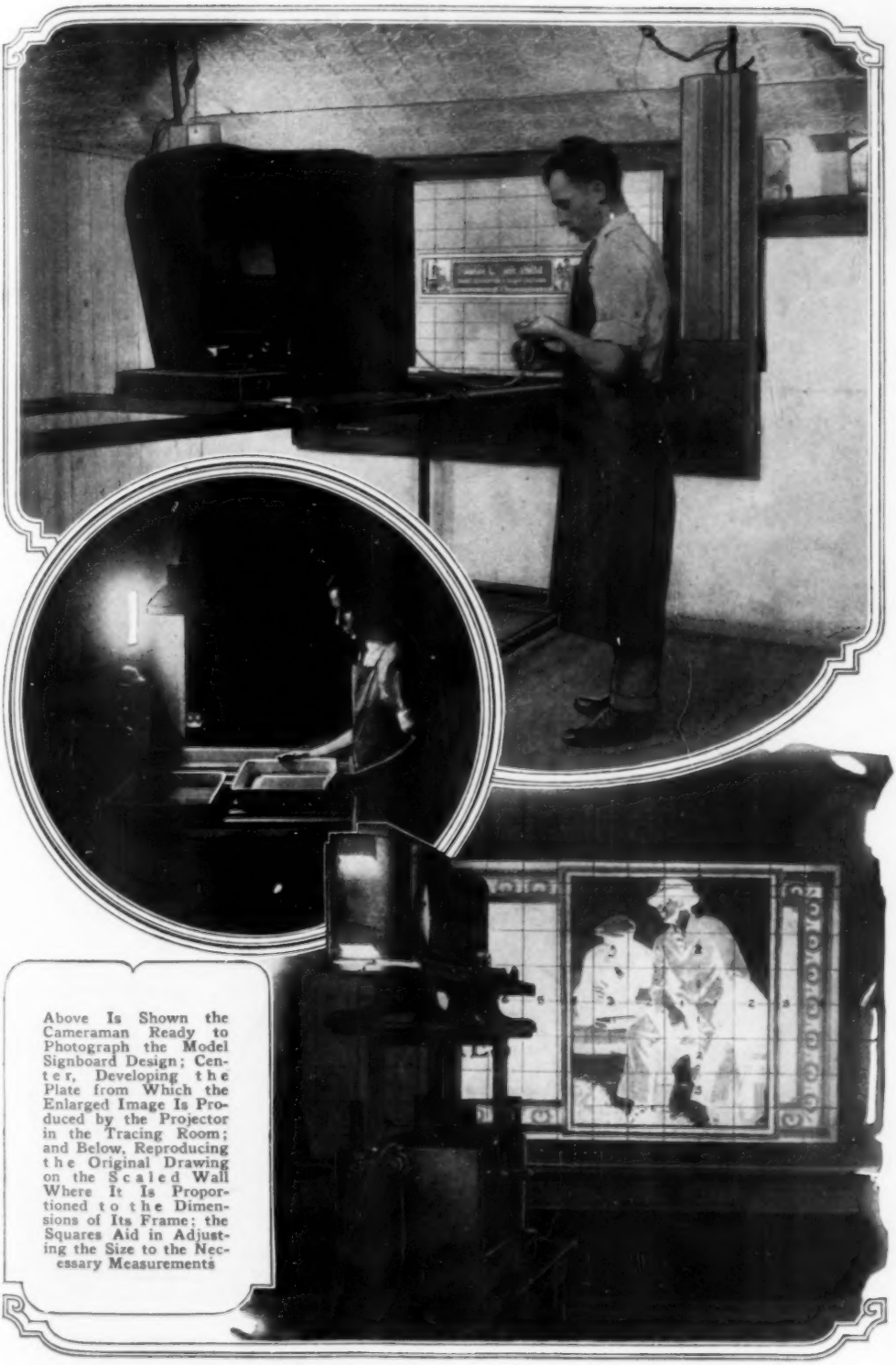
It was about 1890 that the old "slat" form of advertising-display board was first used. Out of this the permanent wooden surface developed, to gradually change into the method employed at present, consisting of all-metal surfaces. With this change, the demand for better and more artistic designing increased, while the steel sheet background affords a superior "canvas" on which the artists can work.

Paper posters for similar display have practically passed through a like change of treatment and preparation. The flaming sheets that once glowed luridly, tacked or pasted on whatever offered a support in the neighborhood of streets or roadways, are rapidly being supplanted by more beautiful lithographs set in large frames resembling the "gallery" variety. The one-sheet "snipe" with its glaring lettered facing, though still seen in many localities, is decreasing in numbers and in its stead the twenty-four sheet poster, fitted on an attractive steel-surfaced board, surrounded by an ornamental molding and plenty of white border space, blends with natural backgrounds.

Due to improvements in the process of printing the sheets, almost any work of art can now be faithfully reproduced for the outdoor display boards. Care is taken by the poster services to remove and replace any paper displays that may be tattered and worn or stained by the wind and weather. Much attention is given to the quality of pastes so as to prevent detachment from the board during high winds.

Before a design is passed for use on the outside, its color scheme is subjected to several tests to determine the clearness of the letters and figures at great distances. Preferred positions, such as on the curves of automobile roads where cars must slow down, are treated under a different set of details than the equally valuable locations along a much traveled railroad right of way. For these experiments one concern has made a large boxlike device with an arrangement much on the order of a stereopticon. At one end of the device the artist's small original is placed and the operator views the sign through eyepieces. This process is said to duplicate the conditions generally met with in the installation of the large signs outdoors.

As Each Section of a Metal Sign Is Finished by the Artists, the Piece Is Covered with a Coating of Waterproof Varnish to Preserve the Delicate Shadings from the Weather



Above Is Shown the Cameraman Ready to Photograph the Model Signboard Design; Center, Developing the Plate from Which the Enlarged Image Is Produced by the Projector in the Tracing Room; and Below, Reproducing the Original Drawing on the Scaled Wall Where It Is Proportioned to the Dimensions of Its Frame; the Squares Aid in Adjusting the Size to the Necessary Measurements

Monument of Giant Figures Recalls Sweden's Champion of Liberty

A group of colossal figures, each more than three times the height of a large man, are being worked into a monument erected in memory of Sten Sture, a patriot of Sweden who lived about five centuries ago. The subjects of the sculptures are taken from among medieval characters. Fully armored knights have been vividly portrayed by the sculptor, Karl Milles, and although all of the figures are in several parts, the pieces must be handled by powerful hoists to set them in place. The site is near Upsala and the group is being partly assembled before the various sections are raised to the supports.

Section of One of the Colossal Figures Which Are to Compose a Huge Monument to the Memory of a Patriot of Sweden

World-Famous Painting Is Restored with Electric Iron and Heater

With the aid of an ordinary electric heater and an electric iron, Leonardo da Vinci's "Last Supper," one of the most famous paintings in the world, has been restored and saved to posterity. Not long ago it was found that the glowing colors were losing their beauty and that portions of the paint had become detached from the walls of the refectory of Santa Maria delle Grazie in Milan, where the great Italian artist painted it five years after Columbus discovered America. An examination showed that moisture was condensing on the paint just as it condenses on the window panes of a room when it is cold outside. An opening was made in the wall between the refectory and the room behind, and an electric heater was installed in the latter. This warmed the wall and at once stopped the dampness. The problem of saving the loosened paint was more difficult. Petroleum was injected into the plaster from the back, with syringes, and later a quantity of liquid rosin. With this as a foundation, an electric iron was applied and the paint scales gently ironed back into place. The area was then varnished to insure the paint's settling firmly. The varnish coating was finally sponged off, and the masterpiece is now said to be in perfect repair.

Cross-Word Puzzle Centuries Old Seen in Ancient Disk

Although the cross-word-puzzle idea, as it is now presented for the entertainment and distraction of millions, is said to have originated in the fertile mind of a newspaper reporter, there is a possibility

that this form of brain teaser really dates back to about 2000 B. C. At least such is the indication of a copy of an ancient terra-cotta disk in the museum of the Johns Hopkins university. The original came from the island of Crete and bears on both sides a continuous spiral line of picture writing. No one has been able to decipher it, hence it is not known whether the legend begins at the center and runs outward or the reverse, or whether the characters should be connected vertically or horizontally. The curiosity is known as the Phaestus disk and, although a German scholar several years ago asserted he had found the key to the puzzle, others refused to accept his claim.

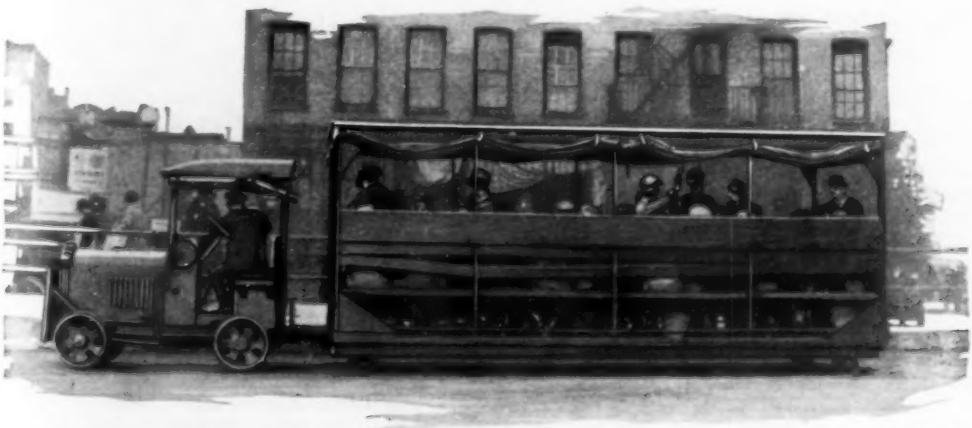
Tractor Car Line Two Blocks Long Operates on a One-Cent Fare

Only two blocks long and running on a one-cent fare, a tractor-trailer system in an eastern city, in spite of its shortness, is considered extremely important, for it has contributed largely to the success of a municipal market located on a side street away from the surface lines. Customers objected to the walk to the cars with their heavy packages so the tractor outfit was devised to solve the difficulty. The trailer, built after the pattern of the old-style open trolley cars with long cross seats and a running board on each side, accommodates twenty-four persons at a time, with strap-hanging facilities for rush-hour traffic. Curtains are provided for protection in stormy weather. The car is run back and forth as a shuttle without turning around and the line carries between 1,700 and 2,000 passengers daily.

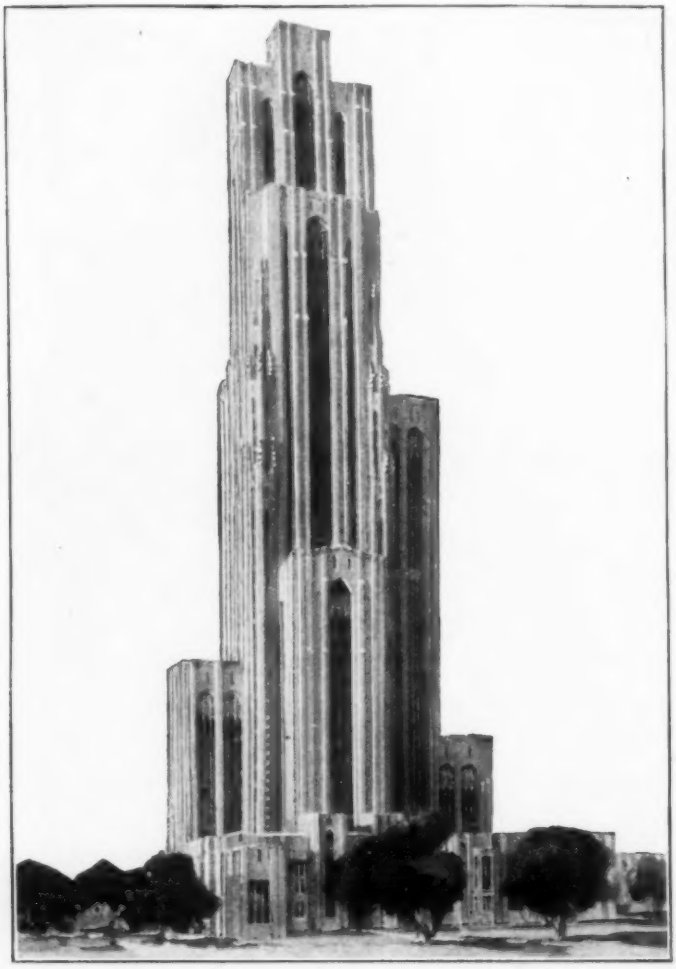
Specimen of the Yama, a New Vegetable Produced by Crossing Squash with Bantam Corn

Cross between Corn and Squash Gives Grower New Vegetable

By crossing yellow bantam corn and hubbard squash, a Wyoming planter has developed a new vegetable called the "yama." About the size of a grapefruit, the product is green in color, with stripes of an orange hue. The yama is said to be easily prepared into a number of palatable dishes. The first crop of the plants to be gathered consisted of 150 dozen, which were purchased by a railroad for free distribution in its dining service. The vegetable's ability to thrive in ordinary soils is expected to make it widely cultivated.



For Only a Penny, Passengers Ride on This Tractor-Trailer Line from Surface-Car Terminal to Municipal Market, Saving a Two-Block Walk with Heavy Bundles



Architect's Sketch of Proposed Skyscraper, Which Is to House All But Two of the Departments of the University of Pittsburgh

University's Cathedral of Learning to Be Fifty-Two Stories High

Skyscraper construction, for many years considered the most suitable solution of housing offices and stores in congested districts, has been chosen for educational purposes in a 52-story structure for the University of Pittsburgh, to be erected this year. Saving of land space and reduction of upkeep costs were important factors in deciding on this type of building, and its impressive height and Gothic lines are to symbolize the dignity and unity of learning and the achievements of modern progress. The skyscraper schoolhouse, called a "cathedral of learning," will be 680 feet high, 360 feet long and 260 feet wide. It will house practically all the university's departments except those of medicine and dentistry, and will accommodate 12,000 students. It will be made of white limestone at an estimated cost of $10,000,000. Sixteen high-speed elevators will be installed. The tower will form a nucleus for future university buildings, and its design and location have been so selected that it will harmonize with surrounding structures.

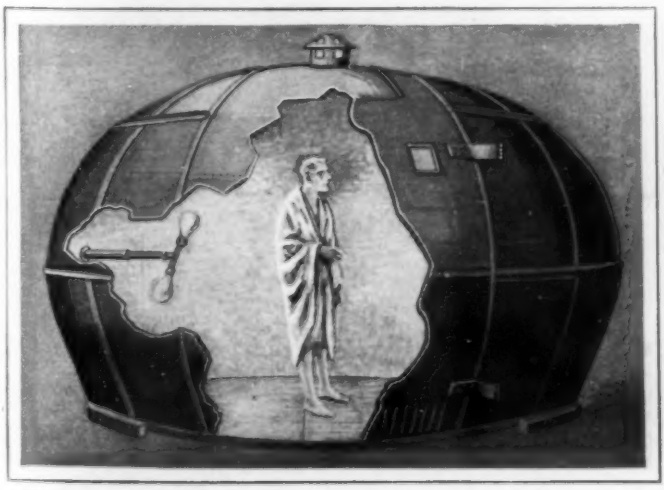
Gas-Electric Bus Saves Fuel

Two hundred gas-electric busses have been ordered for use in Philadelphia. They will be electrically driven by a generator and two direct-connected motors. Acceleration and all speed changes are obtained solely by variation of the engine throttle which is controlled by the usual accelerator pedal. As the engine speed increases, the generator voltage rises, and the bus speed is directly controlled by the foot pressure of the operator, who need not remove his hands from the steering wheel except to apply the emergency brake. No electrical controller is required for the motors, nor are any electrical adjustments made by the driver when running the bus. A small switch is provided having an off position and reverse for backing. Some of the advantages of the electric drive are said to be somewhat lower fuel consumption and a higher rate of acceleration and schedule speeds. With gas-electric transmission it is impossible for the driver to race the engine, and it is also difficult for him to stall it. The electric drive is silent in operation and the customary jerks and noise of changing gears at starting are entirely absent.

¶ More than 300,000,000 pairs of shoes were manufactured in the United States in 1923.

Egg-Shaped Bath Chamber Aids Light Treatment of Disease

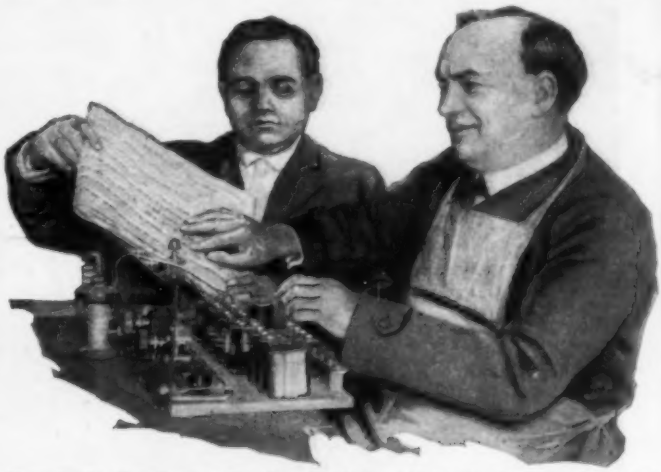
Treating patients with different kinds of light is said to be aided at a Berlin hospital by a huge metal chamber shaped like an egg, in which the person stands while taking the "bath." Entrance is gained through a hinged curving door on the side and there are bulbs at each end of the compartment for projecting the rays. The interior is finished in brightly polished aluminum so that the light is repeatedly reflected with scarcely any loss. The only openings are through a ventilator at the top and slits in the bottom of the door. The chief advantage claimed for this arrangement is that the healing rays strike all parts of the body, a benefit in treating both a general disorder and a disease in a particular organ or spot of the body. Rickets and tuberculosis are among the diseases that have been alleviated with light treatments, and the effects of the rays as projected within the egg-shaped room are said to be akin to those received at mountain or seaside resorts. In certain maladies, a combination of the light-ray baths and an inhaling cure has in many cases been found beneficial, according to physicians.



Cross Section of Chamber, Illustrating How Patient Is Exposed to Direct and Reflected Rays Striking Curving Sides of Cabinet

Blind Workers Build Own Radio Sets from Charts with Raised Designs

As an added occupation and pastime for blind workers having knowledge of electricity or mechanics, they are being taught to construct their own radio sets. Special charts and diagrams similar to blueprints are prepared with lettering and designs in the raised form of the Braille "language" to guide the touch of the fingers. The prints are made for one to five-tube sets, and the sightless mechanics have little difficulty in putting the parts of the apparatus together with neatness and accuracy. The work is said to be thoroughly enjoyed by those blind patients who undertake the task and in a great many cases has resulted in the production of surprisingly well-constructed wireless sets.



How Radio Has Opened Up New Fields for the Blind; Sightless Mechanics Constructing a Set from Braille Chart

One-Piece Vessel Built by Electric Welding

Electrically welded into one piece, the first vessel built by this method has been completed for an oil company for service as a tank steamer. The boat is eighty feet long, has a beam of twenty-six feet and the hull is twelve feet deep. The tanks in the hold have a total capacity of 200,000 gallons.

Spectacular Fires That Appear to Envelop Movie Players Are Generally Composed of Widely Separated Curtains of Flame between Which Actors Safely Carry On

Spectacular Fires That Appear to Envelop Movie Players Are Generally Composed of Widely Separated Curtains of Flame between Which Actors Safely Carry On

When the Plot Requires a Fire

Movies Prefer to Burn Down Their Own Houses and Forests Because Real Flames Lack Conviction When Filmed

WITH a thousand dollars' worth of fire some place in the United States every minute, day and night throughout the year, destroying a dwelling every four minutes, a barn every seven; one hospital, five schoolhouses, five churches and fifteen hotels each day, it seems there ought to be enough flames to satisfy every one.

Seems so, and is so are different, however, and out where the movie reigns, critical directors are busy improving on nature by staging their own personally conducted fires for the films.

Not that every film fire is a flimflam—occasionally a fire breaks out that is spectacular enough to satisfy even a director, and then one will be found on the job with his entire outfit. Such a one broke out in the Lake Tahoe country last summer and swept a path six miles wide and twelve miles long through the national forest in the Sierra country. A hastily mobilized force of 700 men, under Chief Ranger George W. Sallee, were fighting the flames, when a movie producer offered to bring thirty-eight of his actors and extras to help, in return for two days' "shooting." The offer was accepted and some thrilling fire scenes were filmed.

Staging Movie Thrills on the Fringe of Burning Forest Area in California; Insert, Filming Raging Brush Fire in Arizona Foothills

As a general thing, though, even a fire such as this, which destroyed 120,000,000 feet of standing timber, is not as good for movie purposes as a personally staged blaze with a few miniature papier-mache trees and other "props," plenty of studio flares and lights, and a few cans of gasoline and oil.

That sort of fire can be "taught" to act just the way the director wants it to, which the real thing does not. Just when a cameraman gets a good set, with a pall of smoke a mile away for background, the wind will shift, flocks of burning brands will drop around the camera, setting fire to the "set," or the smoke cloud will blow down and obscure the light, sending a coughing, choking bunch of actors

scrambling for safety. A great forest fire emits alternate clouds of blue and black smoke and gases form in the air, spreading a pale green color over all. The dense smoke and gas obscure the sun and render the pictures indistinct.

In contrast to this, the studio "forest fire," arranged in a corner of the lot can be perfectly stage-managed. In one recent film a raging fire was portrayed, which threatened to wipe out about ten towns, a logging railroad, reduce camps to ashes and cause the lumberjacks to flee. Here's the way it was done.

Along a little spur track some brush was piled, some lights planted, some kerosene and gasoline carefully distributed, and through the resulting flames a little logging engine puttered back and forth. It emerged with all parts intact, hardly even smoke-begrimed, but when the "rushes" were developed and viewed in the projection room that night, the film gave the illusion of a roaring mountain blaze.

Most fire scenes in which buildings are destroyed, are also carefully staged, artificially started affairs, though the flames and the destruction are real enough.

Sanitary Table Is Attached to Bed for Sick in Home or Hospital

Easily clamped to almost any style of cot or bed, a sanitary table manufactured

Table Clamped to Bed Frame and Adjusted to Proper Height for Sitting Posture

by a mid-western firm is found a convenience in home or hospital. It is wide and long enough to accommodate a good-sized meal tray, can be quickly and thoroughly cleaned and also gives service as a writing or reading desk. It can be adjusted to various heights by thumbscrews.

Deepest Wells Dug for Oil or Water Shallow Compared to Holes in Sea

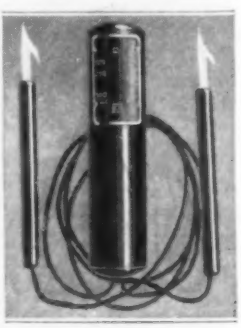
Oil wells more than 7,000 feet deep are not uncommon and seekers for water have been known to bore down as far as 4,000 feet. What is said to be the world's deepest well is near Gobelins in France, where operations were started in 1892 and a depth of over 10,000 feet had been reached by 1914. Compared to the abysses discovered in the ocean, these man-made holes are shallow. Depths of about six miles have been discovered in the Pacific ocean with the aid of modern apparatus.

Glasses Developed for Color-Blind to Correct Defect in Vision

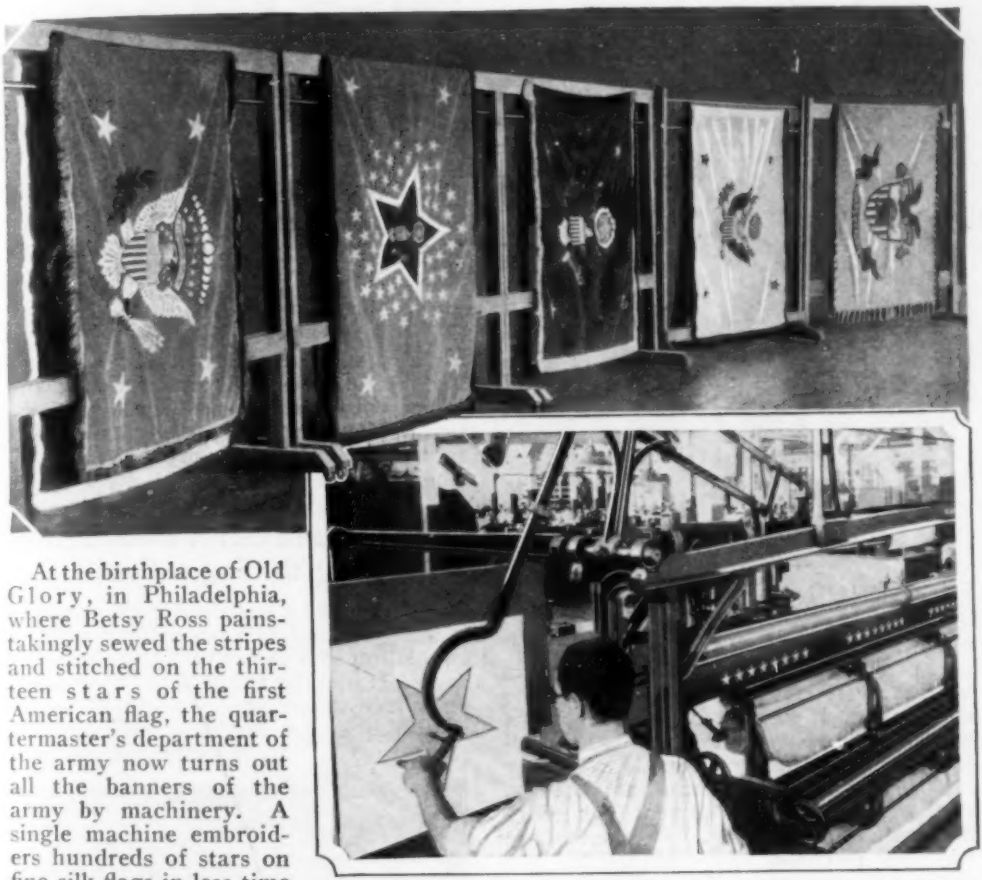
Color-blind persons may be able to differentiate various shades as accurately as others, if special glasses now being devised by opticians prove successful. The lenses in the spectacles are to be colored and will seek to adjust the eyes to record properly the varying wave lengths of light. Inability to perform this function is said to be the chief cause of color-blindness.

Voltage Tester Used without Lamps Indicates Different Currents

Capable of measuring up to 550 volts, a tester that indicates whether the current is direct or alternating has been placed on the market. It consists of a magnet coil within a strong rubber housing and operates a plunger against the tension of a spiral spring. Readings are shown on a plainly marked scale. To facilitate reaching the circuit, long lead wires covered with fiber-insulated handles with pointed hooks are provided. No lamps are needed in making tests with this apparatus.



SEWING STARS WHOLESALE ON U. S. BATTLE FLAGS



Operator Moving Pantograph over Star Design to Guide Hundreds of Needles Stitching Five Flags

At the birthplace of Old Glory, in Philadelphia, where Betsy Ross painstakingly sewed the stripes and stitched on the thirteen stars of the first American flag, the quartermaster's department of the army now turns out all the banners of the army by machinery. A single machine embroiders hundreds of stars on fine silk flags in less time than the revolutionary heroine required to sew on one of her cut-out emblems. The embroidering is done by a Swiss machine, with a pantograph arrangement by which the single operator traces an arm over the enlarged master design, guiding hundreds of needles stitching away on five flags at a time. The machine makes the stars in rows of eight, or forty at a time, on the five flags. Besides the national flags, the factory turns out many types of banners.

Electricity as Modern Farm Hand Cures Hay and Keeps Bees Busy

In the heart of Sussex, England, land of slow-moving countrymen and woods untouched since the days of the Romans, there is a 600-acre farm that is said to be the most highly developed electrically of any on earth. All cultivating and reaping are done by electricity, hay is cured without sunshine by forcing drafts of air through the mows with electric fans, milking machines and churns are motor-driven, brooders for baby chicks are heated by electricity and the hens are induced to produce twenty per cent more eggs than normal during the winter months by having lights in the laying pens at night. Even the working hours of the bees are prolonged and the colonies swarm earlier in the spring by putting them in electric-lighted and heated houses. It is estimated that the use of electric light and power on this farm saves forty minutes of working time a day for every man employed there, and that one kilowatt-hour of current, at a cost of twenty cents, does work that would cost about $3.41 with hand labor, seventy-three cents with horse power and over forty-eight cents with motor power.

Portable Electric-Lighting Plant Operates Automatically

Weighing only about 125 pounds, a compact electric-lighting plant for the home or farm has been placed on the market. It consists of a single-cylinder air-cooled gasoline engine, geared directly to the generator and so arranged

Carrying Generator and Motor of Home Electric Plant Illustrates Its Compactness

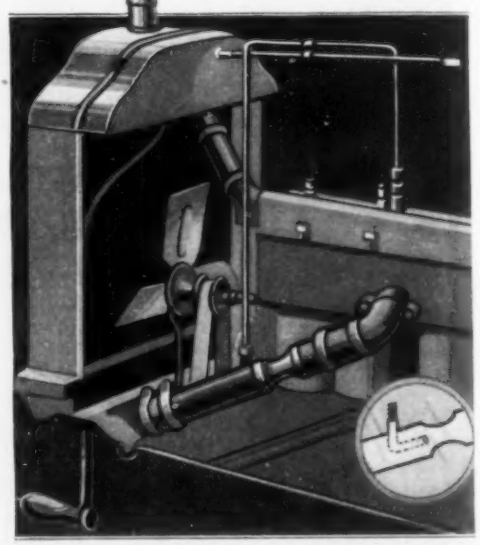
that when the batteries run down to a certain point, the motor automatically starts until it is stopped by a full charge. The smaller model, with storage battery, has a capacity of twenty thirty-two-volt, twenty-watt lamps on the generator alone, or forty lamps on combined generator and battery. A larger size gives current for more lamps and, in addition, will operate the washing machine, electric toaster, iron and other appliances. The entire equipment is simply constructed, without valves to grind, carburetor or push rods to adjust, and consumes but little fuel. A home or farmhouse, barns and outbuildings can be lighted at less expense with this outfit than is possible at power and light rates in many cities, it is claimed. Its portable feature makes it convenient for use in summer cottages and camps, as well as in motorboats.

Use of Raw Coal Is Called a Crime Because of Wasted Energy

Use of raw coal for fuel with the attendant loss of the valuable by-products it contains has been called nothing short of a crime by English authorities who point out the fast decreasing supplies and the relative superior efficiency of oil. This situation is held particularly applicable to Great Britain, which has no natural petroleum resources and only about 1,000,000 horsepower that can be developed from inland waters. In 1923, that country imported more than $200,000,000 worth of oil and mined some 260,000,000 tons of coal of which 155,000,000 tons were burned as raw fuel. It is estimated that one ton of coal will produce three gallons of motor fuel, eighteen gallons of crude oil, two gallons of lubricating oil, thirty pounds of sulphate of ammonia and a considerable quantity of smokeless fuel as residue. On this basis, it is declared, the output of raw coal there, would produce more than twice the amount of motor fuel now consumed besides large quantities of other valuable materials if it were refined instead of being burned in the present wasteful manner. Central electric generating plants where power can be produced at relative small cost, are also regarded as a possible solution of the fuel problem and the smoke evil in cities.

Auto Exhaust Gas Is Used to Help Keep the Engine Cool

Waste exhaust gas of automobile engines is being utilized to keep cooling water in circulation by a device that has no moving parts. It is easily attached to the motor to prevent overheating. Connected to the manifold, a pipe conducts the gas under pressure to the intake water pipe



Auto Engine Equipped with Device Which Utilizes Exhaust to Force Water through Cooling System

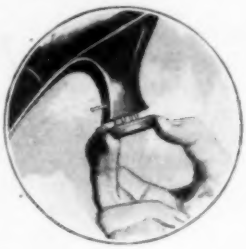
where it forces the liquid to the engine. After it has once been installed, it requires no attention of any kind.

Dirt Cause of Metal "Fatigue" Is Expert's Claim

Ordinary dirt, and not crystallization causes the "fatigue" which results in the breakdown of metals, according to an expert who has just completed studies which, he claims, explode the commonly held theory of change in the arrangement of the crystals which compose the metal. The dirt he blames is the minute impurities which survive the smelting process and find their way into the structure of the metal. "As metals are naturally crystalline in structure, it is evident that breakage in service is not due to crystallization," says this authority. "The metal is a crystalline mass from the time it is first melted and poured. When it solidifies after melting and pouring, it assumes the crystalline character, the same as water solidifies to snow, frost or ice crystals. Researches in metallurgy show that when a motor-car part fails in service, the principal cause is not mysterious at all. It is usually just plain dirt. It is impurity so microscopically fine that without the most conscientious examination it defies detection."

Detachable Heels Are Easily Fitted and Reduce Repair Bills

Detachable shoe heels that can be changed from right to left to correct uneven wear have been placed on the market, so that the wearer can have greater comfort in walking and need not visit a repair shop to make the alterations. The heels are easily fitted and are securely held by pegs one of which, on the side of the upper part of the heel, acts as a lock.



Voice Is Recorded in Talking Movies by Modern "Aladdin's Lamp"

Motion pictures will deserve some other title than the "silent drama" and the whole system of film and scenario technique probably will have to be changed as a result of a process which records the human voice, music and other sounds with the picture and then reproduces them as the film is unwound. This almost miraculous achievement has been made possible by a modern "Aladdin's Lamp," a moving-picture camera which causes the variations in sound to be registered through an extremely small slit upon the film in such a way that they are "played" back when the operator turns the reel. Pictures are taken in the usual way, but the camera, by means of a microphone and a radio tube, picks up the sounds, causing them to affect the light that passes through the slit less than one six-hundredth of an inch wide, and thus obtaining a record of voices and music just as a picture of the scene is being taken. The sounds and views are synchronized when the film is shown.

Section of a Talking Movie Film with Actors' Voices Recorded in the Tiny Scratches Visible at Left

¶Whenever you find that you wish to know more about any article in the magazine, write our Bureau of Information.

Regardless of Rank, Army Officers Assume the Duties of Pupils When They Attend Uncle Sam's School at Camp Vail, N. J., for Practice in Receiving and Transmitting Code by Radio

Training the Eyes and Ears of the Army

Uncle Sam's Unique School Also Teaches Students How to Make and Repair Airplanes

DRAWING a salary for going to school is the fortunate status of students at Uncle Sam's big army air-service technical school at Chanute field, Rantoul, Ill., where four and six months' courses are given in the mechanics of airplane construction and repair, radio and photography. It is the only school of its kind in America.

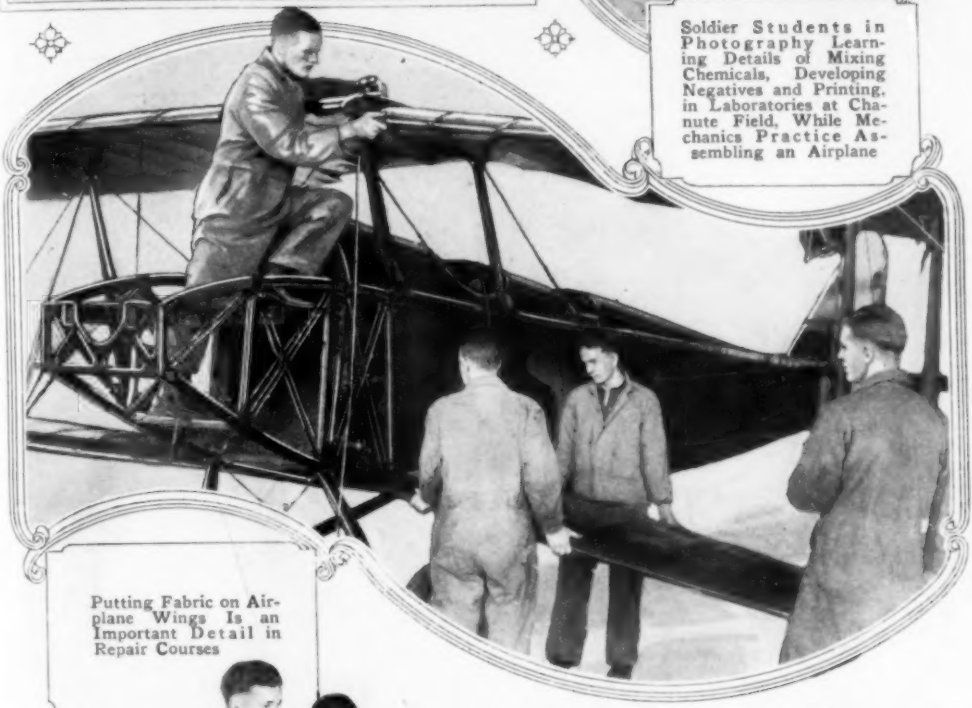
During the war, Chanute field was one of the aviation-instruction camps, but since March, 1920, the school has been strictly a technical institution where pupils draw regular army pay while attending classes. At the end of the six months' course, the enlisted man may, if he desires, buy himself out of the remainder of his three years' enlistment by paying $120 to the government. On a strictly cash basis, he is six dollars ahead even at private's pay, for during the period he has been drawing twenty-one dollars a month and has also received board, room, clothing, medical attention and his instruction.

The field occupies an entire section of land, or 640 acres. On the "campus" are eighteen large buildings devoted wholly to school purposes. There are about forty officers and civilian instructors on the teaching force, and approximately 600 men are graduated each year. The equipment is valued at more than $3,000,000. While some advanced courses are given, the school is planned primarily for the man who has not had extensive academic training. Two years' high-school work is a maximum requirement. Many classes demand not more than one year. Practical experience as a machinist, a garage man or work in similar lines is considered as credit for admission.

In the mechanical division, a man in six months makes all the wire loops used in airplane construction; he learns how to construct and install all the wooden parts and metal fittings, how to cover a wing with the fabric, how to handle and use the numerous special tools, aline the ship, prepare it for flying and how to overhaul and test the motor. At the end of the course, according to the instructors, a student can thoroughly repair an airplane and put one together.

The photography school embraces three

Soldier Students in Photography Learning Details of Mixing Chemicals, Developing Negatives and Printing, in Laboratories at Chanute Field, While Mechanics Practice Assembling an Airplane



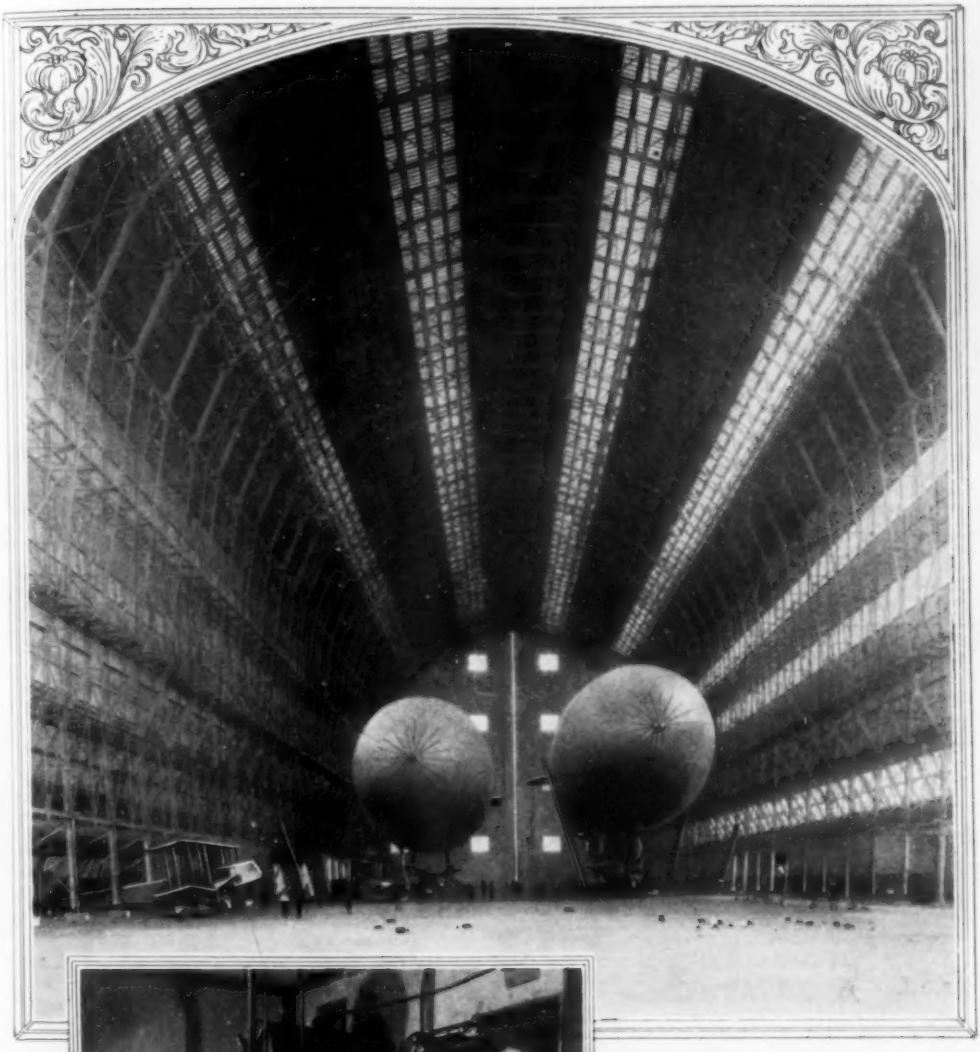
Putting Fabric on Airplane Wings Is an Important Detail in Repair Courses

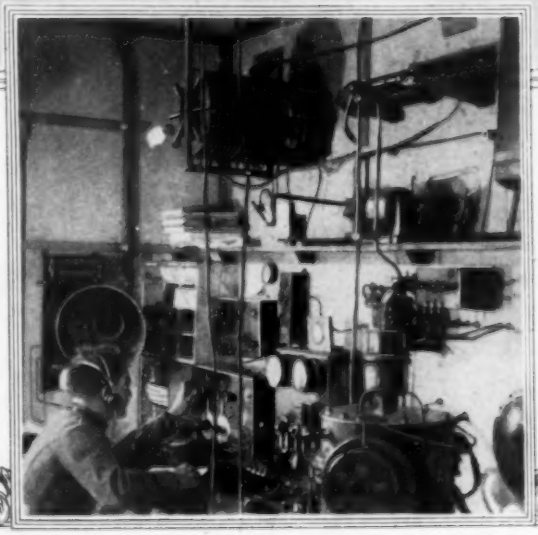
Courtesy of Army Air Service

Engine-Starting Practice with Wingless Planes; Three Mechanics Lock Hands, "Contact," Yells the Pilot from His Seat, the Starters Give a Mighty Pull, the Blade Leaps and the Engine Roars

Repairing a Fifteen-Watt Radio Transmitter Designed by an Army Officer and That Has Flashed Messages across the Atlantic; Mending Sets Is Part of School Work

At Uncle Sam's Army Air Service Schools, Where Airplanes and Radio Sets Are Textbooks and the Hours Are Filled with Action and Practical Instruction





Inside the Hangar at Scott Field, the Home of Dirigibles and Balloons Used for Instruction and Flying Practice during the Ten-Month Courses Given at the School: More than 800 Feet Long and 150 Feet Wide, the Floor of This Structure Would Accommodate an Army of 100,000 Men Standing in Close Formation. The Steel Doors, Built Separate from the Hangar and Running on Steel Tracks, Are Opened and Closed with Electric Motors; Eight Balloons and Six Blimps Are Kept Here at One Time. At the Left Is a Corner of the Army Radio-Transmitting Station at Camp Vail, New Jersey

main sections. One gives an advanced series of sixteen courses for army photographic officers; while another is intended for reserve officers and men in the national guard and consists of fifteen subjects, and the third is for enlisted men. It is the simplest and includes fundamentals in the taking of ground and aerial pictures, developing and printing, the use and mechanism of cameras, and in copying and mosaic work.

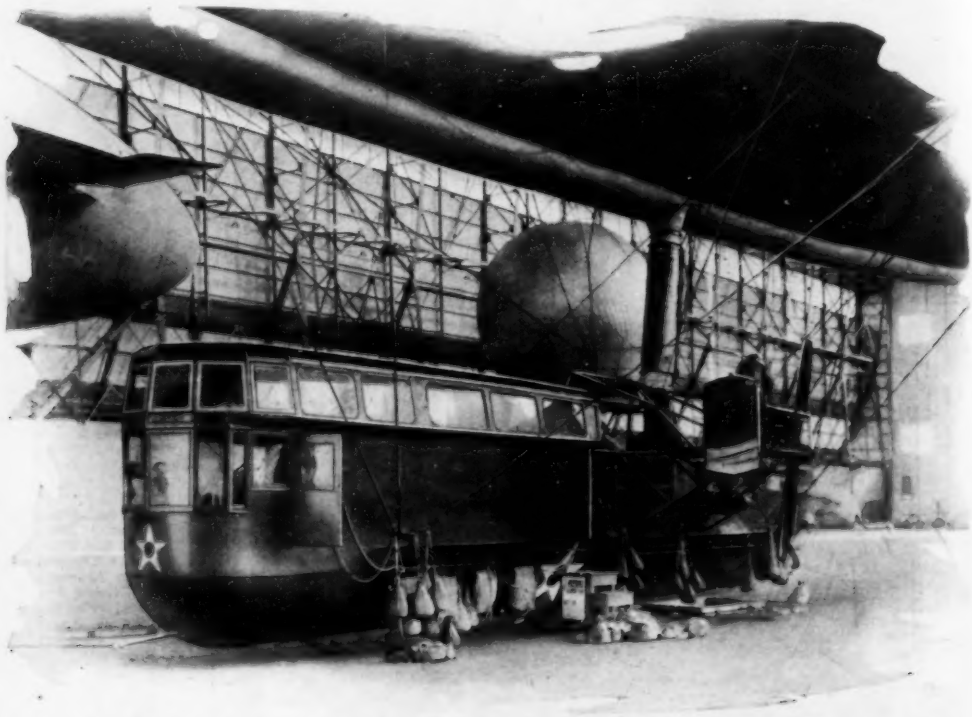
The radio course embraces instruction in electricity and magnetism, in the fundamentals of radio and in the construction, repair and maintenance of radio equipment. Practice at transmitting and receiving wth the "buzzer" and studies of spark and crystal sets, electromagnetic currents and antennas, vacuum tubes, wireless telephony and telegraphy are given in the course.

Supplementing these three main divisions are classes for armorers, auto mechanics, blacksmiths, cabinetmakers, electricians, draftsmen, gas-plant operators, metal workers and parachute riggers. Inventions are encouraged. The camp already is credited with an improved suspension for airplane cameras devised by a photography student.

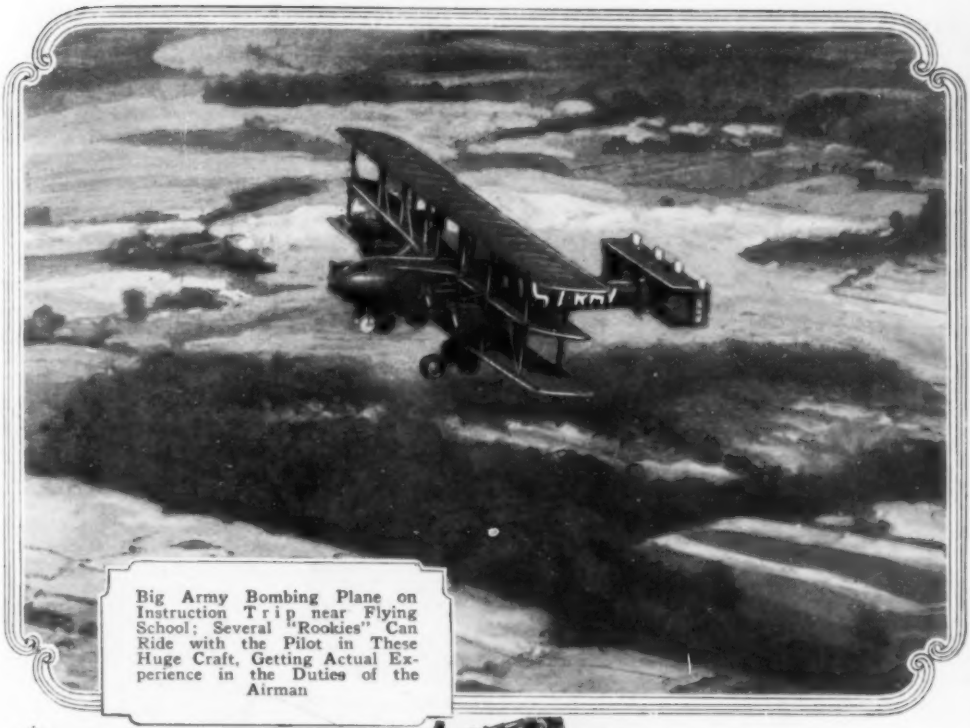
The diversions of a civilian school are reflected in a big gymnasium, a swimming pool, football and baseball teams that represent the post in games with organizations of near-by towns and schools. Tennis games, boxing and wrestling, basket ball, bowling are also provided for, and there are club and recreation rooms for officers and men, and a post band.

Although flying is not taught, planes are in the air daily during photographic and mapping tests and while officers put in the required number of hours in the air to permit them to draw their flying pay.

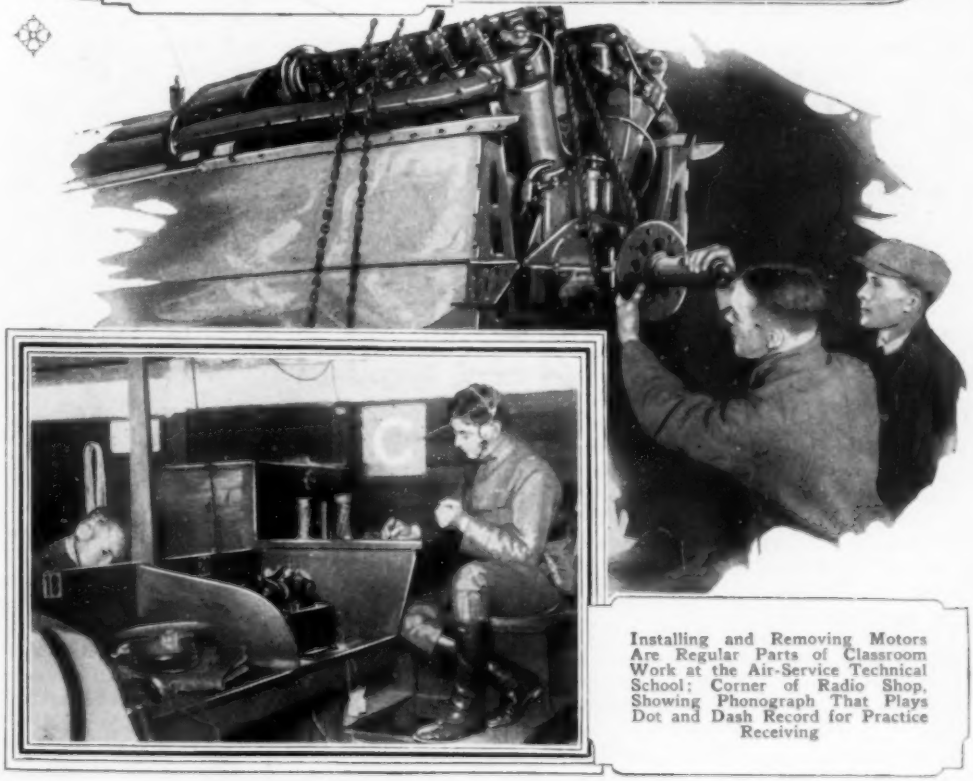
Occasionally an aerial demonstration is given, such as was staged recently for the benefit of army-relief work. Flyers from distant fields dropped in for an afternoon of sport in the air. The deep roar of the bigger planes mingles with the musical whistle of the wind through the taut wires of sprightly messenger and pursuit craft, tumbling and spinning to the continuous crackle of mighty motors. Students get to ride in stately bombing planes that soar majestically over neighboring farms and villages, spelling in their high and graceful flights the progress man has made in modes of travel since the pioneers plodded across the plains.



Car and Ballast Bags of an Army Blimp inside Huge Hangar at Scott Field; Students Master All Controls before Making a Trip in the Air



Big Army Bombing Plane on Instruction Trip near Flying School; Several "Rookies" Can Ride with the Pilot in These Huge Craft, Getting Actual Experience in the Duties of the Airman



Installing and Removing Motors Are Regular Parts of Classroom Work at the Air-Service Technical School; Corner of Radio Shop, Showing Phonograph That Plays Dot and Dash Record for Practice Receiving

Safety Signal for Autos Rings Bell, Flashes Light and Counts Cars

For the protection of autoists and pedestrians at curves, side streets and other danger points, a warning signal has been invented that rings an alarm bell, flashes a red light and at the same time registers the car on an automatic counter. Passage of the automobile over a metal plate set in the street, completes an electric circuit which causes the lamp to flash and the bell to ring. Current can be supplied from the lighting system in towns and cities provided with electricity at a small cost. The double warning of the red light and the bell notifies of an approaching car in ample time to give the other driver opportunity to slow down or stop, as the tread is placed some distance from the signal post. Counting the cars enables engineers to study traffic conditions and frequency of use of the streets, and saves the expense of hiring special checkers for the work. Once installed, the apparatus requires practically no attention. It has been in operation for some time in Asheville, N. C., where it is reported to be the most efficient device of its kind that has yet been found.

When Autos Approach This Corner, "Look" Sign at Right Flashes and Bell Rings, Warning Pedestrians and Drivers

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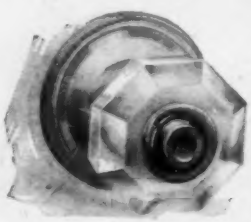
¶It takes a block of wood, two inches high, three inches wide and four inches long, to supply the pulp in a twenty-four-page newspaper. A cord of wood, it is estimated, informs 3,600 persons of the day's news.

Tear-Gas Bath to Rout Stowaways Who Hide on Army Transports

Stowaways who seek free rides on United States army transports plying between San Francisco and Manila, will probably have to carry masks if they expect to succeed in the future, for officials of the chemical-warfare service propose to flood all possible hiding places in the ships with streams of tear gas for at least twenty-four hours before each sailing. The gas is not fatal but is so irritating that no human being can long remain exposed to it. Police in many cities already have used it to drive criminals from their places of refuge. Prior to the sailing, the transport's hatches will be closed and the gas forced into the hold. On a recent trip of the transport "Thomas," twenty-five stowaways were discovered and put ashore just before the ship left Manila bay. Twenty-three more popped out of their hiding places before the boat reached China, and as they could not legally be put ashore in China or Japan, the transport was compelled to carry them to the United States. Stowaways usually try to keep hidden for a day or two, and when found, generally are set to some light task.

Button Lock on Inside Door Knob Eliminates Key and Adds Safety

Inside door locks, secured by simply pressing a small button and released by turning the knob, have been placed on the market. They eliminate keys, spindle and escutcheon plates and are said to be easily put in, since only two holes in the door and four screws are necessary to hold them in place. The button is built into the knob and requires no separate adjustment. Ab-



sence of an outside keyhole minimizes the opportunities for tampering, the appearance of the door is not marred by screws in the knob and the simple construction of the attachment reduces installation costs. Similar locks are made with an outside opening for a key.

Building Erected in Wooden Shell to Protect Workers from Cold

Winter weather with sub-zero temperatures failed to stop building operations on a hotel being erected near Lake Louise, Canada, for the summer-tourist trade. As fast as the structure progressed, a wind and storm-proof wooden shell was constructed entirely around and over the building proper, enabling the 350 workmen to go ahead with their toil and preventing materials from freezing. To carry the 21,000 tons of steel used in the hotel, a narrow-gauge railroad, three and one-half miles long with a four and one-half per cent grade, was laid from the main line.

Model Galley as Realty Office Aids Sale of Land

Real-estate agents in an eastern city have constructed their office on a subdivision near the sea in imitation of a galley, to help advertise the sale of the land. A pirate's figure of heroic size, close by,

Copyright, Keystone View Co.

Real-Estate Office "Camouflaged" as Pirate Ship to Arouse Curiosity and Attract Customers

also symbolizes the days of buried treasure and adventure. The roof of the office is completely concealed by the high sides of the ship and the entrance is partly hidden by the large portholes and panels. The masts furnish convenient vantage points for flags bearing the name of the tract. At night, the signs are illuminated.

Logging Group Carved from Wood Is True to Life in Detail

Remarkable for its beauty and detail, a logging group sculptured from wood has

Curator of Portland Museum Holding Unusual Logging Group That Was Carved from Wood

been presented to the Portland, Oreg., museum by the man who made it. The carving, true to life and deftly molded, shows two spirited horses, completely harnessed, drawing a wagon bed on which there are three logs, held by chains. A driver's seat is perched on top of two of the logs in the rear, and reins extend to it.

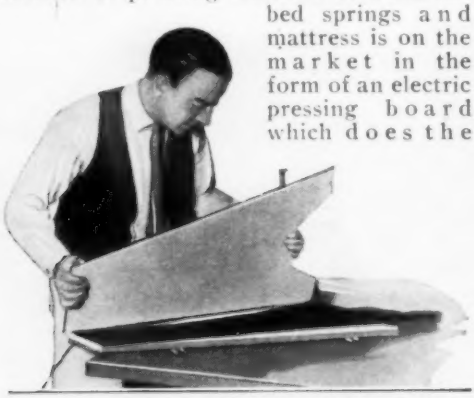
Eclipses Show Days Are Lengthening from Friction of Shallow Seas

On the basis of what they have observed from eclipses, scientists declare that the days of 1925, are about one-tenth of a second longer than the days of 10,000 years ago, and that by the year 11925 still another tenth of a second will be added to the span which we now measure as exactly twenty-four hours. The explanation, those who have studied the problem believe, lies in the friction of the tides in shallow bodies of water, which slows up the earth's daily revolution. Since the war, scientists have actually measured this friction in various places and announce that the amount is sufficient to produce the retarding action.

¶Nearly half of Brazil is said to be covered by forests, little of which is known.

Electric Presser for Trousers Displaces Bed Springs

A substitute for the old-fashioned method of pressing trousers between the bed springs and mattress is on the market in the form of an electric pressing board which does the work in a few minutes. The trousers are placed between the boards at night, the clamps closed, and the extension cord from the heating element is plugged in on the nearest lighting socket. After the heat has done its work, the trousers can be left clamped in place until needed in the morning.



Trousers in Pressing Board with Electric Cord Attached, an Arrangement That Eliminates Irons

Bank's Clock Imbedded in Sidewalk Has Crystal Two Inches Thick

Pedestrians hurrying past a certain bank in San Francisco have but to glance down at their feet to learn the right time. Imbedded in the sidewalk is a large clock protected by two layers of plate glass, each an inch thick, and kept constantly accurate by a master clock inside the bank. The outer glass is renewed every thirty days. The inventor has obtained a patent on the clock, and devised it for special use in cities that forbid installation of overhanging timepieces. Electric lights are set in the rim so that the dial can be illuminated at night.

Bank's Sidewalk Clock Protected by Thick Crystal and Metal Rim

Radio Noises Not Caused by Static Traced with Loop Receiver

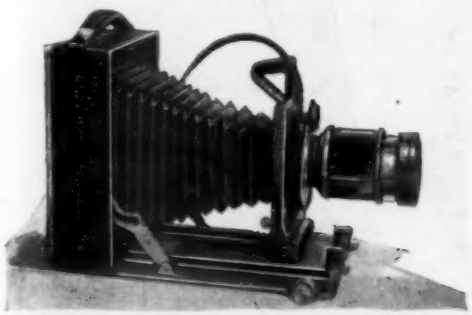
While static is rightfully blamed for many of the noises heard from the radio receiver, power lines, violet-ray machines, elevator motors, electric heating pads, doorbells, gas-engine plants, telephone-bell ringers, street arc lights, trolleys and motors frequently are sources of trouble and not the set. Imperfections in the receiver may be detected by connecting the antenna and ground terminals with a wire. When this is done, no signals or noises intercepted by the antenna can reach the set; so, if howls and whistles are heard, they must originate in the apparatus itself. The problem of locating an outside source of interference is a difficult one, but it can be done, as reports of a government radio supervisor in a southern city show.

Broadcast reception had been rendered almost impossible by roaring that, in some sets, could be heard a distance of two city blocks. Preliminary investigations with an ordinary loop receiver showed that the trouble was due to a 13,000-volt transmission line feeding back into the street lighting circuit, an old arc system in which tungsten lamps had been substituted. But there was a particular leakage somewhere which caused most of the noise. A special three-circuit receiver, employing a detector and one stage of audio-frequency amplification, was constructed to hunt for the offending interference. It was lined with tin on all sides of the cabinet and all telephone and battery leads were shielded to prevent induction except

through the loop mounted on top of the receiver. The government inspector and an official of the local power company toured the city for two nights carrying the set in an automobile and making tests at different residences. The transformers in the particular transmission line were under suspicion, but the loop had to be pointed toward the middle of the street, where a light was suspended, to keep the noise at its loudest. The inspector got out of the automobile and while his companion listened at the set, he tapped the light. The interference fell to nearly zero and then rose to maximum intensity. But the trouble did not lie in the light itself. It originated in a guy wire to the lamp post lying across the primary of a 2,300-volt circuit. When it was removed, the interference was eliminated.

Adjustable Lens for Hand Cameras Gives Many Focal Lengths

Screwed into the front of the regular shutter, an adjustable lens for hand cameras, that gives a great number of focal lengths, has been placed on the market. It is used in place of the original lens,



Folding Camera Fitted with Adjustable Lens That Gives Wide Variety of Focal Lengths

and when the bellows are at normal extension, an image of nearly double the usual size is produced, it is said. On long-bellows cameras, adjustment of a knurled collar on the front of the attachment, gives images of various size in "telephoto effect" up to the limit of the lens.

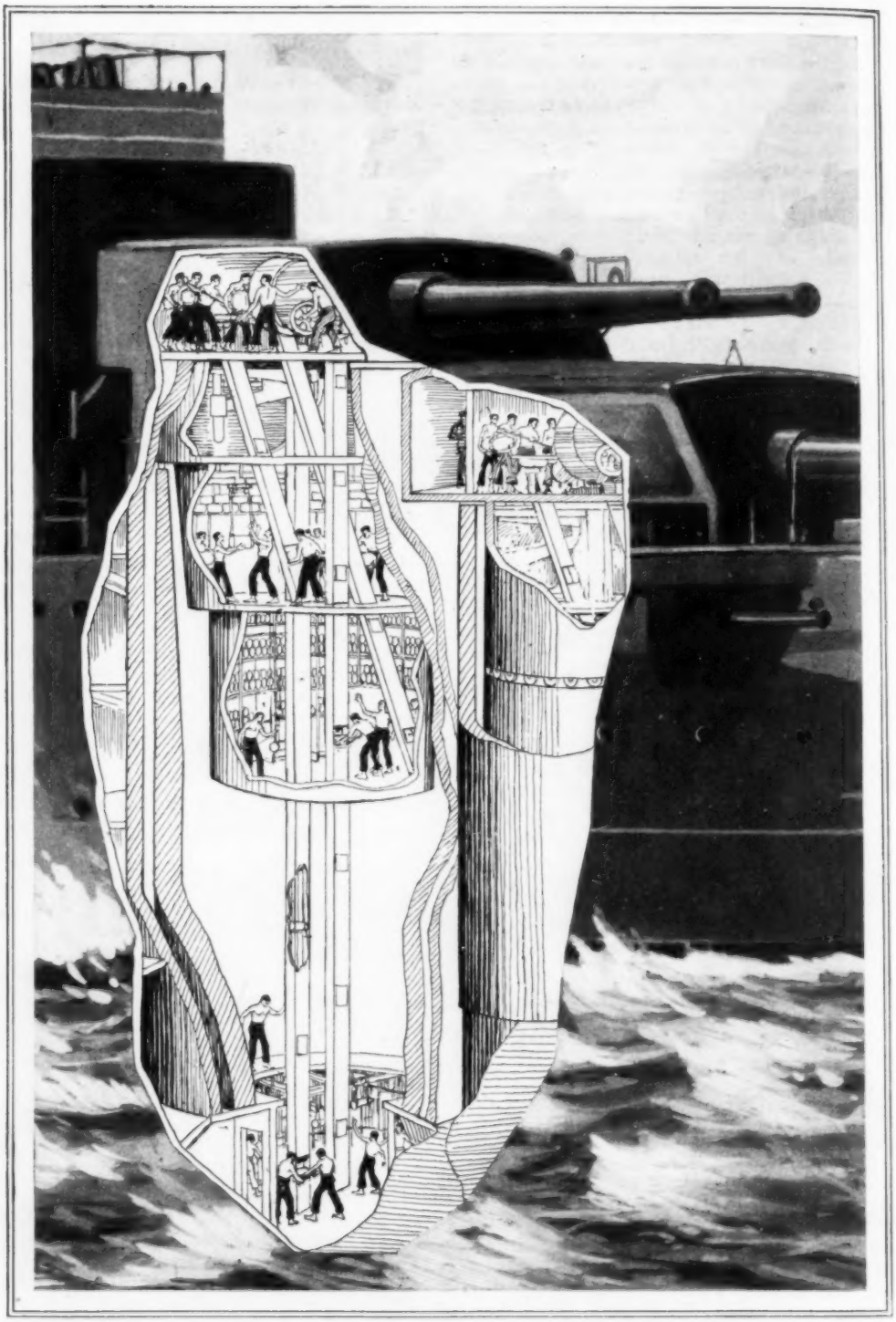
Dry-Land Swimming Rack Teaches Right Strokes in Two Lessons

With the aid of a machine invented in England, beginners are said to be able to learn the right swimming strokes in two lessons. The pupil lies prone on a cushion and his hands and feet are strapped to special pads. When the instructor turns a crank, the student's extremities are automatically made to perform the correct swimming motions as the rests to which they are attached are moved in the proper order by a chain-gear arrangement.

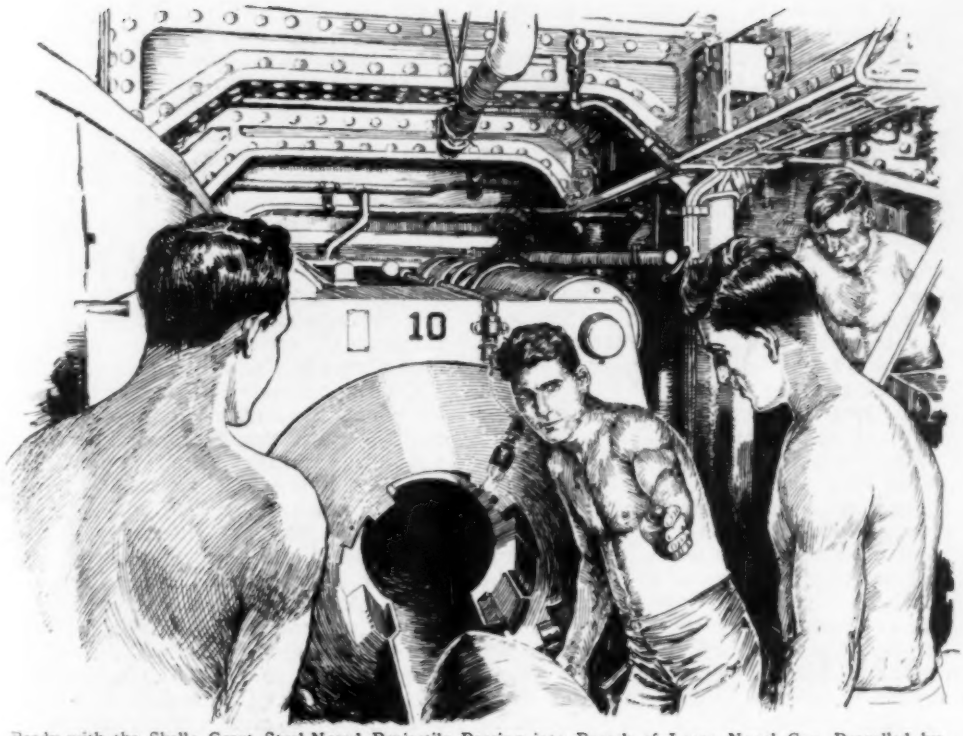
Swimming Pupil on Instruction Rack, While Teacher Turns Crank Moving Arms and Legs of Subject in Proper Strokes

Cab Driver Quicker in Use of Brains than College Students

That chauffeurs of taxicabs think faster than college students in meeting emergencies while driving automobiles has been indicated in tests described by Dr. E. A. Moss at a meeting of the National Civil Service reform league. Women scholars in like situations established the next quickest record for rapid mental work. In the experiments two revolvers were fastened under the running boards of the car used to try the skill of the subjects. While the machine traveled at high speed, an examiner riding within fired one of the pistols by pulling a wire, and the other was set off automatically as the driver applied the brakes. The time elapsing between the two shots indicated the mental agility of the operator. The average time between the two explosions for competing cabmen was .413 of a second, and that for women subjects .459 of a second, while male students set .590 of a second as their average.



Artist's View of the Service Chambers beneath the Huge Gun Turret of a Modern Battleship from Where Endless-Belt Conveyors Carry Tons of Ammunition to the Loading Platforms



Ready with the Shell; Great Steel-Nosed Projectile Passing into Breech of Large Naval Gun Propelled by Automatic Electric Ram Which Handles the Load with Ease

Behind the Big Guns of the Navy

How Unseen Crews in Turrets of Combat Ships Aim and Fire Giant Rifles

By G. K. SPENCER

"FIRE...fire...fire...fire...fire..." So went the steady drone of a human voice which reached the gunners of number three turret, aft battery, U. S. S. "California," through a brass tube which opened into the solid little firing room of the first of the three guns in the turret. The voice came as though from a great distance. Simultaneously an electric bell sounded, confirming the voice signal. A shot did not go forth with each word "fire," but it did signify that, each time the word was heard and the bell rang, the guns were "on the target" and that a shell, if let loose at that moment, would go true to the target.

Stripped to the waist under the electric light, the gun crew, with scarce six inches in which to turn their bodies, flung levers, pressed buttons and keenly inspected the gun's bore after each shell had left the turret. Curiously enough, no shock was felt inside the steel fort as the successive explosions rocked the ship from stem to stern. The decks outside were cleared and not a soul appeared on them. Cowering in protected spots, the deck force held their ears and awaited the firing. Within the turret, scarce a ripple occurred. We knew a shell had left the muzzle by the undulating motion of the ship as the explosion outside threw the vessel sharply to starboard. The guns were firing to port, assuming the target were an enemy which had engaged on the port beam—which means directly off the side of the ship, and neither forward nor aft. With the command "commence firing," a seaman pulled a lever and an elevator from forty feet below shot up and deposited a bag of powder at the side of the gun breech. A 1,400-pound shell fol-

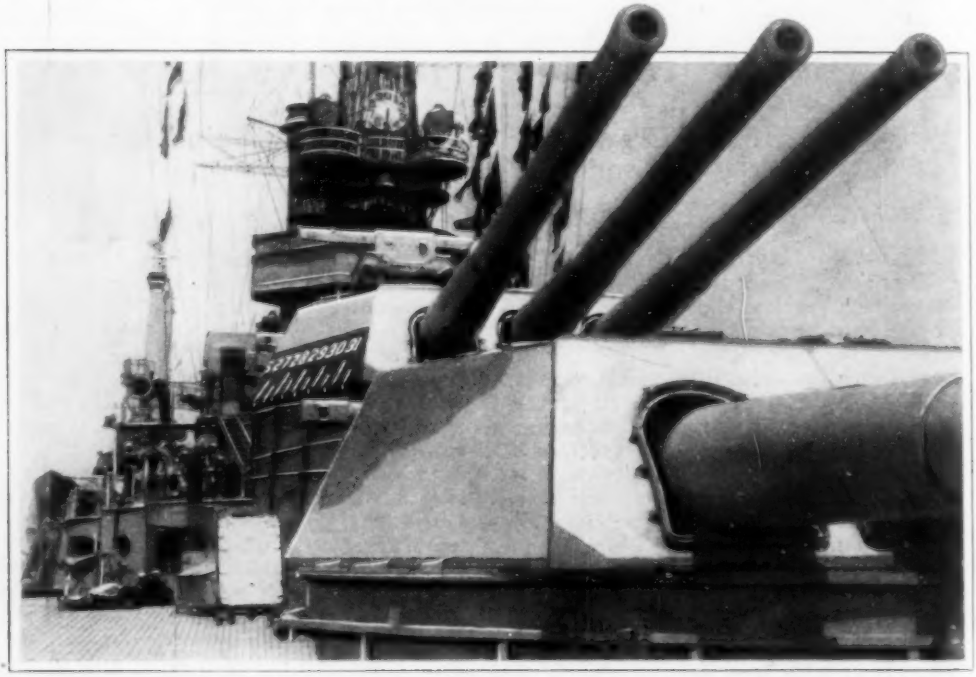
lowed from thirty feet below, in a tubular hoist, and deposited itself in a trough leading to the gun breech. An electric rammer, operated by a seaman with a lever in his hand, rammed in the shell and withdrew; the powder, rolling into the trough behind the shell from its little elevator, was also rammed into the breech; the breech was closed and at one of the commanding words to "fire," the shell was ejected. Speed is the essence of the operation, a ship which can get out two shots in three seconds from three guns, being rated higher than a ship which gets out ten shots in twenty seconds, even though all may be hits. The navy's word is, "It's not the number of hits you get in an hour that counts, but the number you land in a minute."

Each turret of the "California" is composed of four decks. On the first deck three gun breeches are seen. To gain entrance, the crew crawl up through an airtight door under the moving top portion, and wriggle in, thereafter shutting the hatch tightly behind them. Once inside, one is impressed by the amount of machinery. This mechanism performs almost automatically. Brass, levers, buttons, signals, duplicate signals, precautionary devices, handling implements designed to operate with a leverage of only a few feet, represent the solution of thousands of engineering problems.

On the first deck, also, is a sighting apparatus. The range-finding devices are stationed atop the turrets, in the open, and might be easily shot away. They are duplicated, however, in the fighting tops, on the bridge and at various other points, and are all connected by telegraph and speaking tubes to the plotting room, so that no matter if two, three or four range finders are shot away, the "plotters" always have enough operating to get the ranges. Of course, radio from the spotting planes is also utilized.

On the second deck, is the mechanism by which the turrets are moved around, and the guns elevated and lowered. On the third deck, is the shell room. The center of the room is stationary, but the sides of the turret, filled with shells and solid projectiles on shelves, move around it.

On the fourth deck, the powder chutes jut out from secured magazines on all sides. A crew of men are here seen carrying the great powder bags to the elevators. Painted warnings on all sides instruct how to flood the magazines in case of danger. These men, in the event of catastrophe, almost never escape.



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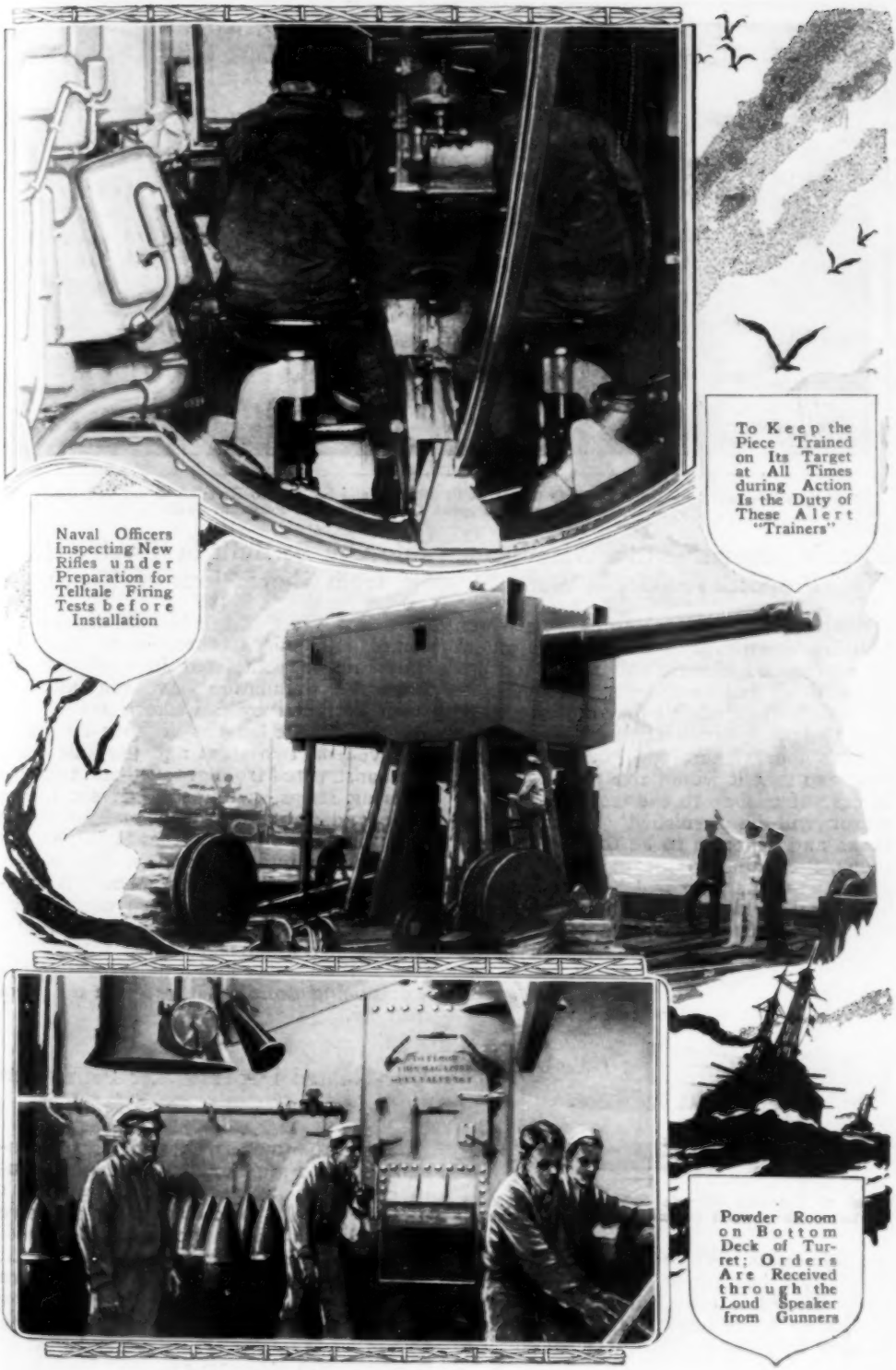
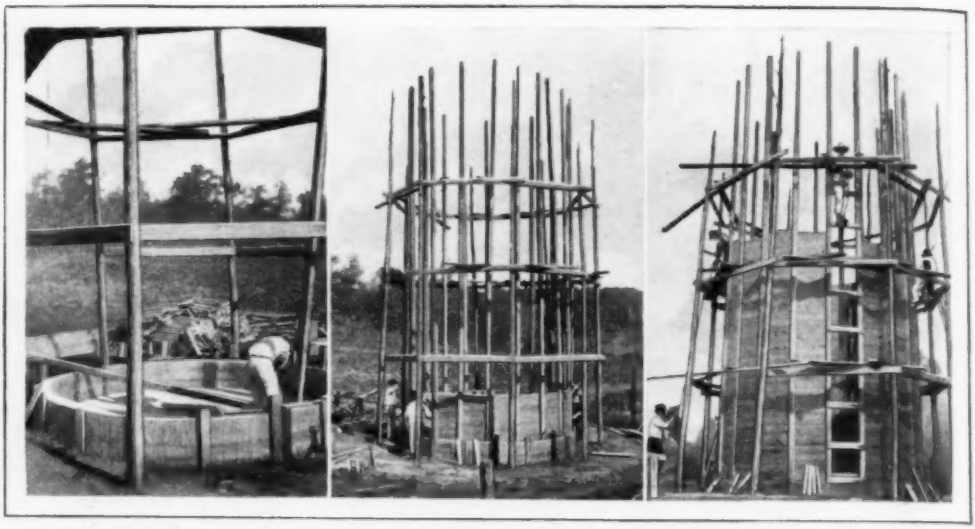
Heavy Armor-Steel Turret of the U. S. Warship "Mississippi," Which Withstood Force of Terrific Powder Explosion That Claimed Lives of Many of Gun Crew Serving the Rifles



Naval Officers Inspecting New Rifles under Preparation for Telltale Firing Tests before Installation

To Keep the Piece Trained on Its Target at All Times during Action Is the Duty of These Alert "Trainers"

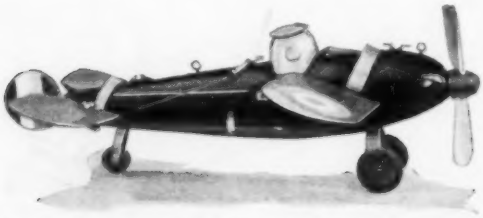
Powder Room on Bottom Deck of Turret; Orders Are Received through the Loud Speaker from Gunners



Stages in Construction of Short-Timbered Silo from Foundation and Scaffold to Erection of the Tall Uprights and Addition of Tongue-and-Grooved Crosspieces That Form the Wall

Electric Submarine Like Monoplane Proposed for Use in War

Shaped like a monoplane with its wings pointing downward instead of up, a model of a proposed electric submarine for use in bombing and torpedoing has been exhibited. While wheels on the bottom are provided to permit cruising about the ocean's floor, the craft will be lighter than water so that it would rise to the surface in case of mishap to the motor. The operator will be furnished oxygen supply tanks and vision is to be through a periscope, according to the plans of the designer. Submerging will be accomplished by increasing the speed and operating the rudder. Over the cockpit, a dome-shaped protector is to be provided, with hatch



Model of Proposed Electric Submarine Fitted with Pilot Protector and Downward-Pointing Wings

and side lights. While an actual submarine of this type has not been constructed, the model is said to have indicated that such a machine is not impracticable and might be used to good advantage in attacks on fleets.

Silo Can Be Built in Twelve Hours from Short Pieces of Timber

A farm silo that can be built from short boards that might otherwise go to waste, and can be completed in twelve hours after the foundation has been laid, has been designed by a western man. Uprights used are lengths of "four-by-fours" grooved on two sides and the side walls are constructed from grooved and tongued flooring strips, two feet long, six inches wide and two inches thick. The object of utilizing the short pieces is to simplify the task of building, and in case a section rots, it can easily be replaced. A number of these silos have been constructed and are giving good service in the south, the designer reports, and one was put up in less than a day and a half, most of the work being done by boys from a school near by.

Tar-Coated Paper Water Pipe Used as Substitute for Metal

Water pipe made of paper has been invented by a Frenchman and is being manufactured in a machine that winds it directly from a tank containing adhesive material with which the paper is coated. The final layers are covered with tar and a finishing coat of bitumen is given before the pipe is laid. Sections are joined by winding a special kind of fabric over the bell-shaped end of one length and that of the next, which fits into it.

Pioneers to Be Carried by Airplanes to Settle Canadian Wilds

With radio communication already successfully established between settlements in the Peace and Mackenzie river valleys in northwestern Canada, it is now proposed to establish airplane transportation into the region for the benefit of new land seekers venturing into the territory. The government, it is reported, is to launch the scheme this summer. If the plans are carried out, "schooners of the skies" as modern versions of the covered wagons which carried earlier settlers across the western plains, will soar over the deep woods and rough mountains of the province, speeding their passengers to remote destinations in a fraction of the time it would take to go by pack trains.

Racer Auto with Front-Wheel Drive Built for Speedway Tests

Driven as well as steered by the front wheels, a racing automobile has been constructed by a western sportsman for speedway tests against cars of the usual type. The differential is inclosed in front, just below the radiator, and the driving shafts behind the large suspension rod between the wheels. The steering rods are below.

Front - Wheel Drive Racer with Motor below the Radiator

Designers of automobiles are especially interested in the speed developed by the racer, how successfully it can be guided and the performance of the brakes.

Cabinet for Removing Excess Hair Is Intended to Destroy Roots

Among the latest inventions for beauty parlors, shown at a hairdressers' exhibition in New York city, was a cabinet arrangement for removing superfluous hair

How a Patient Takes Cabinet Treatment for Removal of Superfluous Hair from the Face

by treating the roots to destroy the tissues that supply them nourishment. The subject taking the treatment is said to suffer no ill effects, and is not exposed to the danger of infection or disfigurement. The apparatus is controlled with a system of dials and has an extension drum against which the face of the patient is rested during an application.

Coal Mining under Ice Fields of Arctic Goes on Year Round

In spite of the long winter night of the Arctic, coal fields lying beneath thick layers of ice, snow and rock in Spitzbergen, are worked throughout the entire year. The first deposits of the fuel found in that country were discovered in 1900 under forty feet of ice and about twenty feet of solid rock. Demands for the mineral during the World War led to extensive operations. A volume of coal reaching 90,000 tons was exported in 1919, and the annual production increased so rapidly that more than 335,000 tons were mined in the past year. All of it is shipped to Norway, although companies of many nationalities do the mining.

Courtesy Whaling Film Corp.

With Blazing "Try Works" at Which Busy Crews Rendered Oil from a Day's Harvest of Blubber, Old-Time Whalers Filled Night Seas with Weird and Lurid Glows

Whale Hunting Far South Today

Floating Factories and Swift Steam-Driven Craft Pursue Blubber-Bearing Quarry Now Retreating to Remote Seas

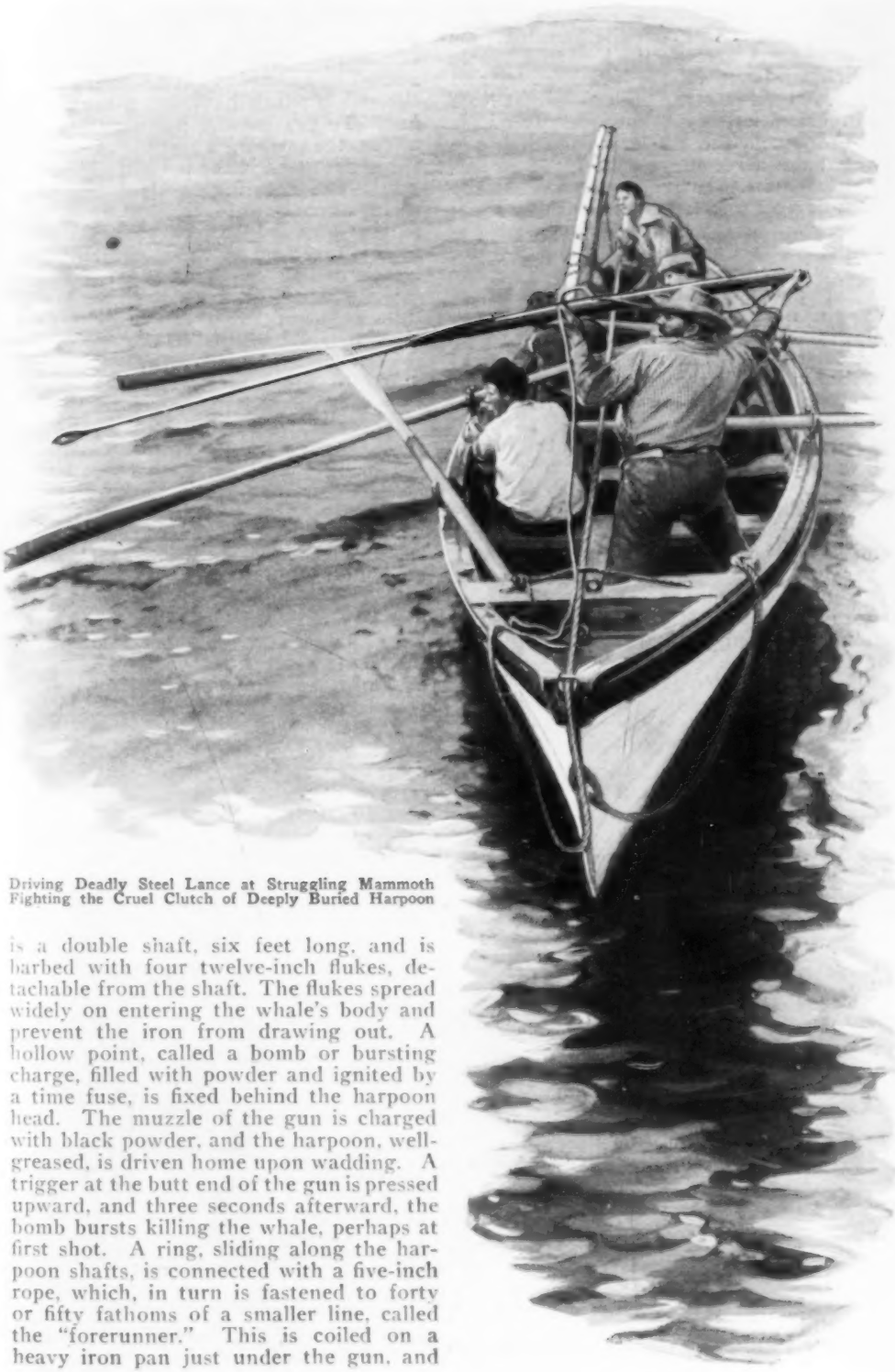
By HAROLD T. WILKINS

THE romance of the seven seas hangs like a halo over the old-time whale hunters, whose daring and endurance made American seamanship famous in every part of the globe. "A dead whale or a stove boat," says the inscription on the striking whaleman statue in the grounds of the public library of New Bedford, Mass. The safety of the crew then often depended on the alertness of the man who stood ready to cut the harpoon line at the critical moment when the maddened whale was lashing the water with its terrible flukes.

Today, however, whaling as an industry is true to the type found on the Aleutian Islands, Alaska, or at South Georgia and the lone, desolate islands, populated by elephant seals and penguins, which are scattered along the edge of the great Antarctic circle of ice floes. The modern whaler is a steel-built, steam-driven vessel, about 115 feet long, light in structure and capable of high speed and rapid maneuvering on a specially rounded keel. These boats ride the water like corks and roll and pitch in the slightest seaway.

No longer is whaling a quest for whalebone, a ton of which, worth at one time $10,000, has been found in the mouth of the large right whale or bowhead. Baleen or whalebone is made into highly artistic toilet articles in Japan, but the market for it elsewhere is now very small.

A powerful harpoon gun is mounted on an iron support in the bow of the ship, and swiveled so that it can be turned up or down and from side to side. The harpoon



Driving Deadly Steel Lance at Struggling Mammoth Fighting the Cruel Clutch of Deeply Buried Harpoon

is a double shaft, six feet long, and is barbed with four twelve-inch flukes, detachable from the shaft. The flukes spread widely on entering the whale's body and prevent the iron from drawing out. A hollow point, called a bomb or bursting charge, filled with powder and ignited by a time fuse, is fixed behind the harpoon head. The muzzle of the gun is charged with black powder, and the harpoon, well-greased, is driven home upon wadding. A trigger at the butt end of the gun is pressed upward, and three seconds afterward, the bomb bursts killing the whale, perhaps at first shot. A ring, sliding along the harpoon shafts, is connected with a five-inch rope, which, in turn is fastened to forty or fifty fathoms of a smaller line, called the "forerunner." This is coiled on a heavy iron pan just under the gun, and

gives slack to the harpoon as it flies through the air. From the pan, the rope passes over a roller in the bow to a double winch in front of the wheelhouse, and thence down into the hold, where at least a thousand fathoms is carried. By means of the winch, the whale is played as one would use a reel on a fishing rod in salmon streams. Imagine yourself on the deck of a steam whaler off South Georgia, a bleak and lonely island in the South Atlantic, where the whaling season is from November to the end of April. The day is gray and dull, with heavy clouds banking the horizon, and a strong sou'wester blowing over a sea upon which the steamer rolls and pitches heavily. About 9:00 a.m., a shout comes from the lookout in the crow's-nest on the foremast, "Whale on the starboard bow!"

Far away on the horizon a white column of vapor shoots up into the air. The whale has come up to "blow," and oxygenate its blood. Pink-stained patches of water denote the presence of shrimps or "plankton," the whale's food. The animal turns over on its side, and closing its vast under jaw upon its upper, gulps down the shrimps, rejecting the water in a great shower streaming from the baleen plates of its head.

The telegraph in the wheelhouse rings for half speed, and the round-bottomed steamer quietly creeps through the water toward the vast bulk of the whale, which the captain, scanning it through binoculars, declares to be a finback, sixty feet long. Suddenly, the quarry submerges, and then reappears twenty fathoms away, blowing with a whistling roar. The harpooner sights his gun. There is a terrific report, a volume of dense smoke, and the lanced bomb belches from the mouth of the gun, trailing a rope, and buries itself in the back of the whale, which hurls its body and flukes out of the water, arches its back, and violently dives, nose down. Hissing from the winch, the hawser, which can stand a strain of twenty-eight tons, runs out over the ship's bow, the steamer following in its wake.

Again the captain rings, this time for half speed astern, and the whale, beginning to feel the pull of the ship, dives and reappears near the ship, blowing. Another harpoon is fired, and the whale, lashing the surface, at last lies on the water nearly exhausted and spouting fountains of blood mingled with foam. Forty minutes later, a small boat, called the "pram," is launched, and three sailors row to the victim. Lance in hand, a man stands in the bow waiting an opportunity to give the beast its deathblow by thrusting the lance into its side. The whale sinks but comes up again, floating dead upon the sea. The carcass is hauled to the ship by the steam winch heaving on the harpoon line. To prevent the parting of the rope under the strain, a series of powerful springs is fitted in the bottom of the ship's hull. The securing tackle is led to the springs by way of blocks well up the mast, so that any sudden jerk or strain on the rope is taken up by them, preventing dislocation.

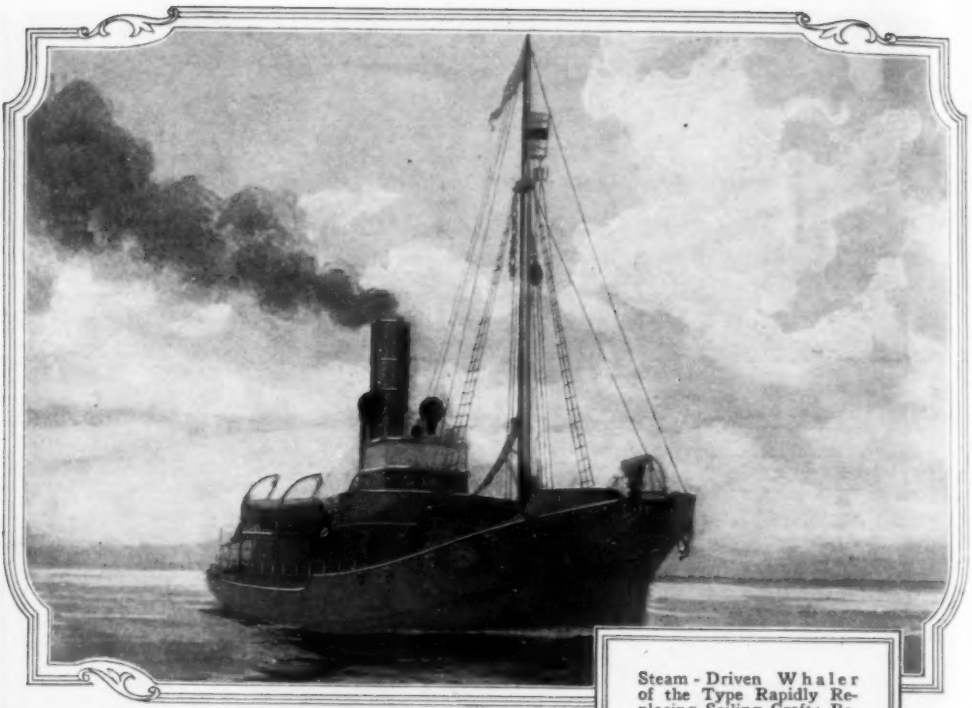
Once alongside, the whale is made fast by a chain passed over the flukes of its great tail, and secured to the towing bitts. A hollow air tube is driven, harpoon fashion, into the carcass, and through this tube it is inflated with air forced in by a compressor in the ship's engine room; this, of course, to prevent it from sinking.

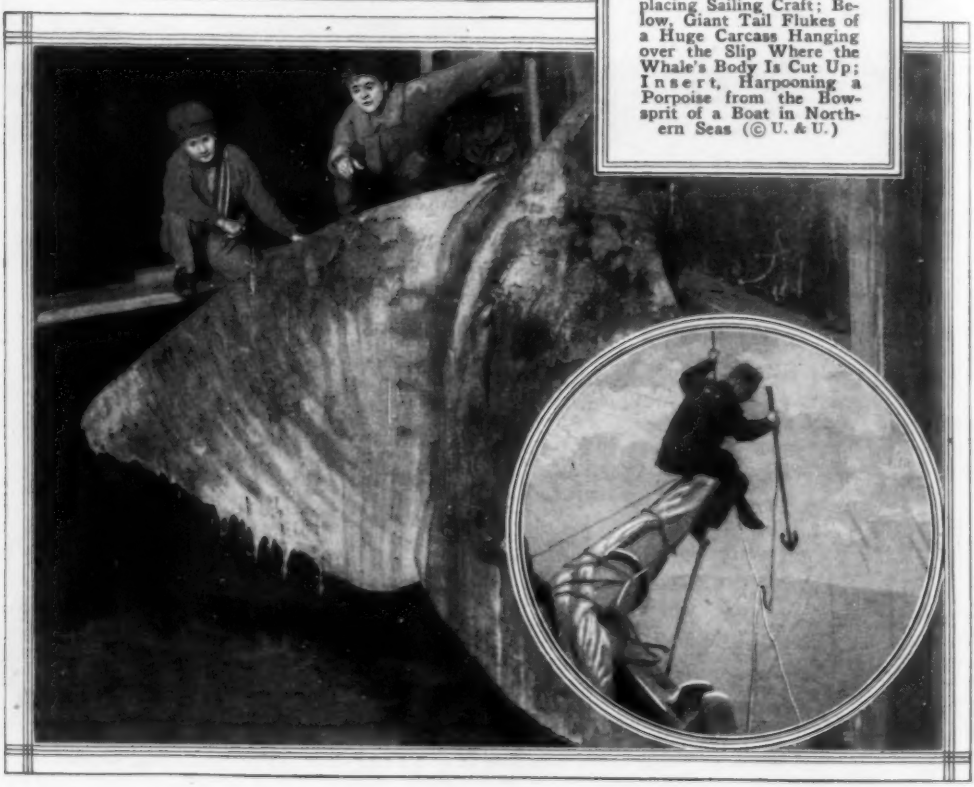
Towing one or more whales, each over half its own length, the steam whaler returns to its base which is a shore station lying in a bay or cove close to the sea. A typical modern shore station, such as may be found in South Georgia, is a striking collection of buildings. The flensing slip, on which the dead whale is dragged first to have the skin and blubber removed, attracts the eye. Hard by are the carcass platforms surrounded by boiling vats, a machine for drying the flesh, the engine house, wharf, offices and manager's house. An all-pervading odor of steamed flesh comes from the drier. All parts of the carcass, even the blood of the large finner whale, are used.

Besides the shore stations, large steamers, known as floating factories, are equipped to deal with the whales brought in by four or five steam killers, and they return home with the whale oil at the end of the season. A forest of derricks, elevators, chutes and machinery crowds the decks of these factories. Here, the carcass of the whale undergoes similar treatment to that at the permanent shore station. Revolving knives cut up the blubber, which is shot by elevators up and down chutes into steaming vats where the oil is extracted. This is then cleaned and refined and run into tanks. These ships can deal with six to nine blue whales, which average eighty feet in length, or twenty finner whales in a day. It is stated that, in about four months of the whaling season of five to six months, a floating factory can produce 30,000 barrels of oil from 600 whales.

The ships are cut off from the outside world for many months, and carry a complete engineering shop, and carpenters' and

Fate of a Seasoned Whaler Driven by a Relentless Gale on to a Rocky Coast Where Heavy Seas Pounded the Vessel to Pieces Before Aid Could Be Summoned





Steam-Driven Whaler of the Type Rapidly Replacing Sailing Craft; Below, Giant Tail Flukes of a Huge Carcass Hanging over the Slip Where the Whale's Body Is Cut Up; Insert, Harpooning a Porpoise from the Bowsprit of a Boat in Northern Seas (© U. & U.)

blacksmiths' establishments. Their crews of 150 have to spend some six months in the Antarctic regions, and then undergo a return voyage across the equator home. Every available place on board ship is filled with coal, and distillers and evaporators are provided to furnish water, the supply of which is a very difficult problem at stations such as the South Orkneys and Shetlands.

In these far-southern waters, the British government has been forced to restrict the issue of licenses to establish whaling stations, and has compelled the floating factories to use not only the blubber but also the remainder of the carcass, which was formerly turned adrift.

Modern whaling is not without its thrills and its pathos, however. Some years ago, a Norwegian steamship, off Tromso, had fastened a rope to a humpback whale (forty-five to fifty feet long), when it rushed madly against the side of the boat and, smashing through the hull into the engine room, let in a great flood of water. The fires were extinguished and the ship sank in three minutes. The crew had barely time to launch a boat, and were rescued by another whaler some hours later. The sperm whale will deliberately turn on its pursuers and sweep the water with devastating blows of its huge flukes, smashing the boats or crushing them between its immensely powerful jaws.

In the narrow and rocky channel of Cape Brett, New Zealand, the migrating humpback whales are trapped in wire nets, 600 feet long and 200 feet deep, hung on strong cables and buoyed on great floats. When a whale is sighted from the headlands, steam launches set the nets, which are allowed to float loose, hampering the whale by their entangling wires and making it an easy prey to the hunters.

It should be realized that whales are hunted in every sea of the globe. Therefore the herds are thinning, year by year, and the time is already in sight when they will become, if not extinct, so shy and wary that it will not pay to hunt them in the inaccessible ice floes to which they have retreated. Ruthless hunting has all but killed the industry off Newfoundland, and from the whaling "grounds" in the neighborhood of Japan, where whale meat, fresh and canned, is a staple article of food, the humpback whale will soon have vanished.

Unloading a Treasure of Whale Oil from a "Floating Factory," a Stout Craft Equipped with Every Need to Reduce the Captured Animals to Articles of Commercial Value

Two Steering Wheels on Auto Help Beginners Learn to Drive

Fitted with two steering wheels connected by a sprocket chain and with a double clutch arrangement, an instruction car used by a southern automobile dealer has been found of great aid in teaching beginners how to drive. Women, especially, become more familiar with the mechanism of the auto and acquire skill in driving much more quickly when they can actually turn the car with the wheel. Danger of accidents is minimized by this method and the pupil has gained confidence before assuming control of the auto unaccompanied by a teacher.

Woman Pupil Learning to Drive Auto in Double-Steering-Wheel Instruction Car; Posts Are Connected by Sprocket Chain

Airplane Taxis for Inter-City Service at Twenty Cents a Mile

Plans for the manufacture of "aircabs" for an inter-city taxi service, to operate at a rate of about twenty cents a mile for each passenger and a schedule of 100 miles an hour, have been announced. The sponsors expect to operate a demonstration fleet of nine planes in Chicago, in conjunction with units of three in each of four other cities. The craft will be capable of making sixteen miles on a gallon of gasoline, it is expected, and will be painted a color that has already been adopted by several taxicab lines. A former air-service aviator is at the head of the manufacturing company.

Signal Corps Plans to Send Maps by Radio

"Airplanes, radio and cameras will win the next war." This is the commonly heard prediction when possibilities of further conflicts are being discussed. Whether right or wrong and whether or not there is another war, the efficiency of the army's signal corps is being greatly increased by the development of these three inventions. Now that photography has been coupled with radio, signal officers are developing a system whereby diagrams, sketches and entire maps can be sent through the "communication net" of 100 radio stations now under the direction of the army. The army is also making use of commercial dictaphone apparatus in teaching Morse and radio code work. Hard rubber records, practically indestructible, are used for receiving practice, the students taking the sounds down as the record is "played" through a set of relays. For sending, the students employ soft-wax cylinders and gain practice in re-running and copying them.

Memo Clip on Telephone Saves Time and Keeps Notes Safe

A metal spring clip which can be quickly snapped on or off a telephone without the aid of any tool is designed to prevent the loss of messages and memorandums. Notes and letters may be inserted in the device, which holds them in a position to easily attract the notice of persons near the instrument. By keeping papers from becoming mixed with other material, the holder guards them from being blown away or being mistaken for waste. Sheets of

data and letters may be placed in the clamp for reading while a telephone user is occupied in writing with his free hand. As an aid to proper distribution of office mail, the clip may be employed as a container for individual correspondence, insuring immediate attention to unopened matter and keeping it separate from other papers.

Baseball Game with Dummy Batter Tests Player's Ability

Amusement-park visitors who like baseball and also enjoy testing their skill, are to have an opportunity of enjoying some of the thrills of the real game in a concession device recently patented. It consists of a realistic figure of a ball player with bat in hand, a revolving disk carrying balls suspended above his head, and a lever in easy reach at the operator's booth placed the usual distance in front. The object of the game is to pull the lever, which is connected to the bat, at the proper instant so that it strikes one of the balls whirling by as the disk turns. If the play is successful, the ball is swung to an upright position and held out of the way. The speed of the revolutions can be made fast or slow. The disk is generally fitted with three balls and score is kept by counting the number of hits and misses.

Dummy Ball-Game Booth with Batter, Balls on Disk and Lever That Operates Bat

Girl's Skill at Art of Gem Engraving Opens New Field for Women

Gem engraving, an art dating back to the times of ancient Babylon, has received a new impetus in late years, and the demand for portraits and designs carved on semiprecious stones has increased with developments in the styles of setting. Much of the success of the gem engraver is said to lie in his deftness of wrist in controlling the amount of pressure given the stone as it is held against the tiny lathe, and the skill of a young woman apprentice in the art seems to indicate that women are peculiarly adapted to the task as they naturally possess a keener sense of touch than men. The engravings are made either in base-relief or intaglio, that is, sunk beneath the surface of the stone. Delicately shaped cutting tools, using diamond dust mixed with oil as an abrasive, are employed to form the designs, which are first marked out in blocks and then copied to scale on the stone to be cut. If the stone is held too hard against the tool, the dust wears off, leaving the surface too smooth to be cut. The correct amount of pressure causes the fine material to lodge in the pores of the steel, making it act somewhat as a file.

Skilled Young Woman Apprentice Cutting Portrait on Gem with Special Lathe and Tools

Pedal on Auto Accelerator Assures Smoothness and Driving Comfort

For cars and trucks, an accelerator with pedal attachment to insure more uniform gasoline feed and greater comfort in driving has been devised. It is so arranged that the pedal and gas button may be operated in unison with only four ounces' pressure, while, because of a sliding brake-shoe arrangement under the footrest, more than thirty-five pounds' pressure is required to depress the pedal unless the button is touched first. The two fit closely together for easy operation.

Latest Ideas in Building Your Home

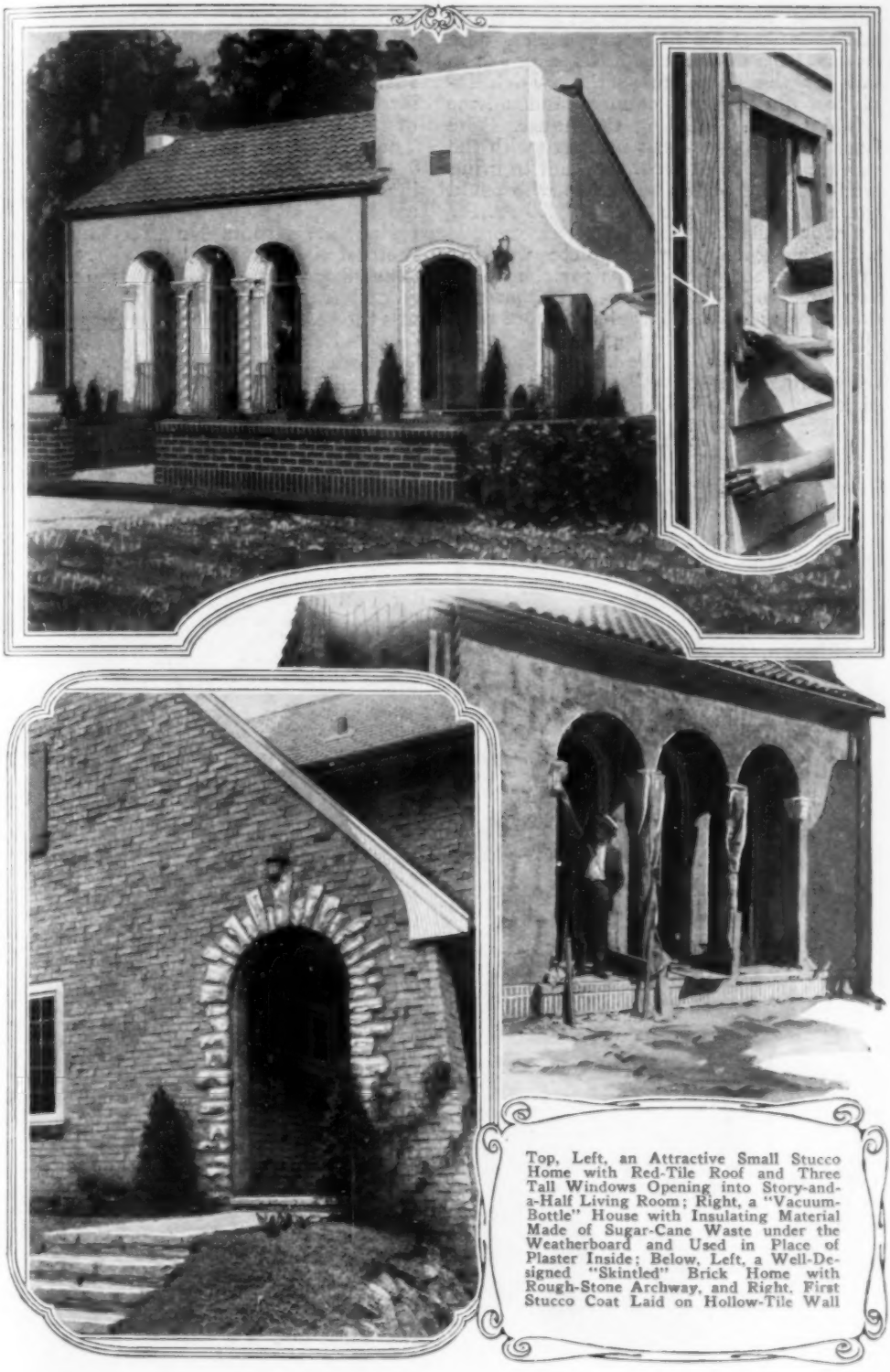
Space, Time and Labor-Saving Devices Make Small House Luxurious without Boosting Cost to Prohibitive Figure

By J. EARLE MILLER

ARE you going to build a new home? Or would you build a house of your own if you could get the kind of home you want for the price you can afford to pay? It is possible to do that now. The architects of the United States have set themselves the task of making the nation's small homes attractive, comfortable, economical, durable, and yet keep the cost within the limits the average builder can afford to pay. They have done it by discarding all the old methods of home building. They began by analyzing the average house, finding what was unnecessary and leaving it out, and then prepared figures to show what each feature that may go into your home will cost, whether it is a necessity or a luxury, and whether, if you have it at all, it must be built at the start, or can be added later.

Homes for generations have had cellars, first as a place to store provisions and later for the furnace, but with modern heating plants a cellar is not necessary, the architects say, and proceed to point out how you can save one-fifth of the cost right at the beginning by forgetting about a basement. If you use gas or oil for fuel, the heating plant can be installed in the corner of the kitchen, provided it is one of the new-style furnaces that look like something else—a talking machine, for example. If you use coal, the architects have discovered that it is cheaper to build an additional room to hold the furnace and coal pile than to dig a cellar, give it a cement floor, put in walls and buy the other things a basement needs.

The new idea in home building is the work of the Architects' Small-House Service bureau, an organization to which any architect is eligible if he buys a share of stock at a cost of $100, on which he is permitted to earn $8 a year. It is not a profit-making body. Divided into seven regional bureaus, the organization members produce plans for attractive small homes suitable to each section of the country. The best plans are then purchased by the bureau, paying the regular $300 or $400 fee. Complete copies of plans, specifications, buying list, quantity survey, and duplicate



Top, Left, an Attractive Small Stucco Home with Red-Tile Roof and Three Tall Windows Opening into Story-and-a-Half Living Room; Right, a "Vacuum-Bottle" House with Insulating Material Made of Sugar-Cane Waste under the Weatherboard and Used in Place of Plaster Inside; Below, Left, a Well-Designed "Skintled" Brick Home with Rough-Stone Archway, and Right, First Stucco Coat Laid on Hollow-Tile Wall

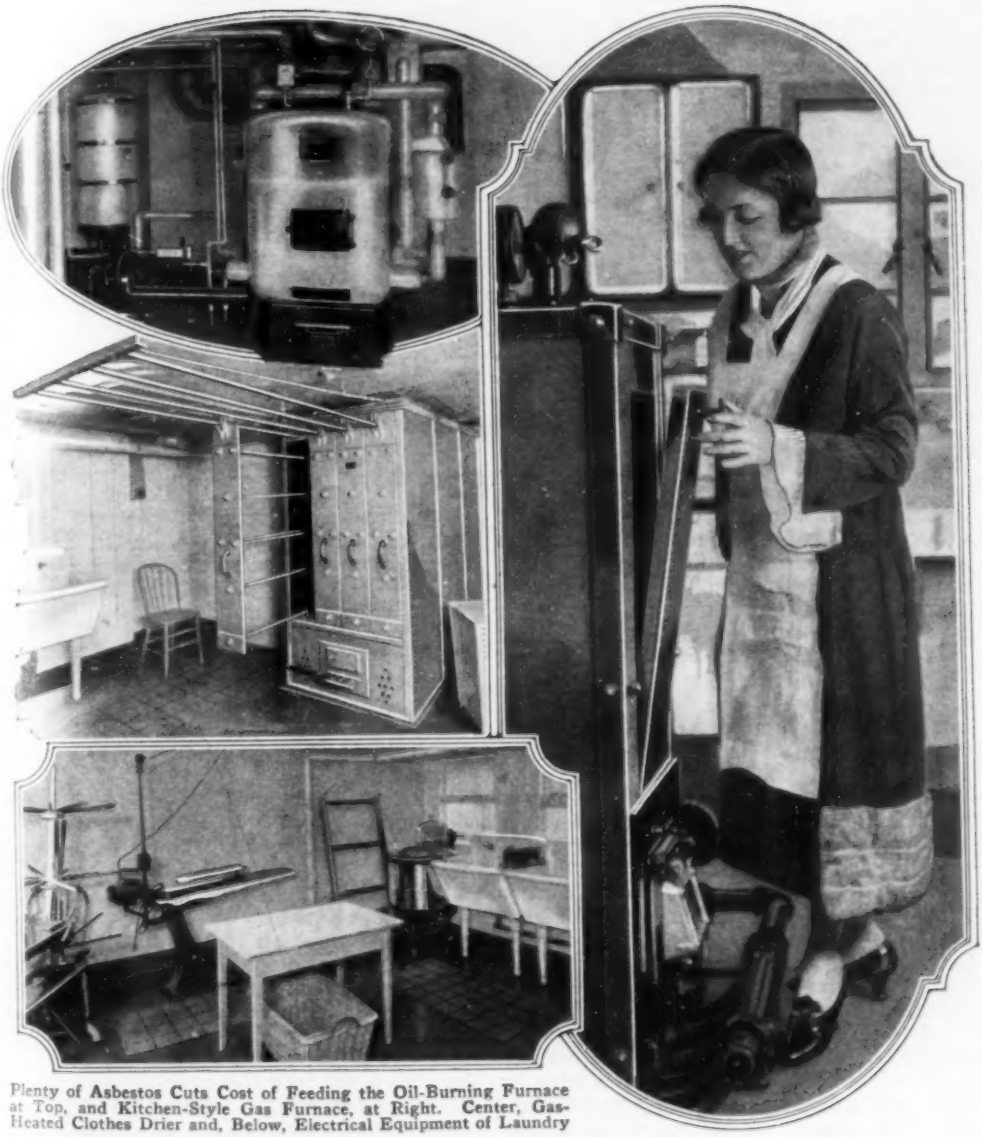
forms of "fool-proof" contract agreements are then supplied to home builders at a nominal fee of about $5 a room, or $25 to $35 for the complete service, which includes professional counsel and advice while you are building the house. The bureau is not aiming to interfere with the private practice of architects, but to bring well-designed homes to people who could not afford to pay the $300 or $400 fee for individual plans.

Besides furnishing complete working drawings and other details for the house you want to build, the bureau has printed floor plans and photographs of more than 200 model homes, ranging from three to six rooms, and sells the booklets at cost to permit prospective home builders to pick out the style of house they want. After the selection is made, complete plans may be obtained on approval.

Robert Taylor Jones, of the American Institute of Architects, who is technical director of the bureau, has compiled a list of forty ways to save money in building. The cost of the model homes may vary $2,000 or $3,000, depending upon what luxuries are added or omitted. One of the most popular plans for the northwestern region, a six-room Dutch colonial type, has cost all the way from $6,500 to $10,000, depending upon whether a porch was added or left off, whether the hardwood trim was the best of the five grades or a cheaper one, and similar details.

If you are going to have a cellar, he says, it is not absolutely necessary to put in the partitions when you build, except for the fuel bin. The others can be added later, and you will save $50 to $150 by omitting them at the start. If you have a fireplace you may expect to pay $300 or $400 extra for it, perhaps even more, depending upon the material and labor costs. The brick foundation course improves a wooden house and is almost necessary under a stucco home, but the higher it goes the more it will cost. From $50 to $150 may be saved by limiting it to the lowest practicable height. When cutting off the non-essentials, he suggests the porch as the

Top, Space-Saving White-Enameled Kitchen Equipment Includes a Broom and Mop Closet; Below, Right, Combined Refrigerator-Kitchen-Cabinet Unit. The "Pullman Nook," Left, Is a Convenient Breakfast Alcove



Plenty of Asbestos Cuts Cost of Feeding the Oil-Burning Furnace at Top, and Kitchen-Style Gas Furnace, at Right. Center, Gas-Heated Clothes Drier and, Below, Electrical Equipment of Laundry

first sacrifice, since it can always be added later. The saving may be anywhere from $300 to $600, or more. A glass-inclosed porch is expensive, not only requiring window sash and glass, but interior trim, painting and a better grade of floor. The extra cost of glazing the porch may run to $500 or over. Screening the porch is an additional expense; double screens cost more than single ones, and metal frames more than wood. Screen wire comes in painted steel, galvanized steel, copper or bronze, and he advises buying the one best suited to the purse. A nine-inch foundation wall, he finds, is usually sufficient for a small home, and costs one-fourth less than a twelve-inch wall. Prices of brick, poured concrete, concrete blocks and tile vary in different localities, and a bit of careful shopping for the cheapest usually pays. If you are going to have a basement it is not necessary, Mr. Jones points out, to follow the custom of extending it under the entire house, which involves extra excavating and foundation walls. The cement floor, he suggests, may be added later, if you can't afford it at once.

Tile makes a fine bathroom floor, but may cost from $25 to $50 more. Exterior stucco walls will cost from $150 to $250

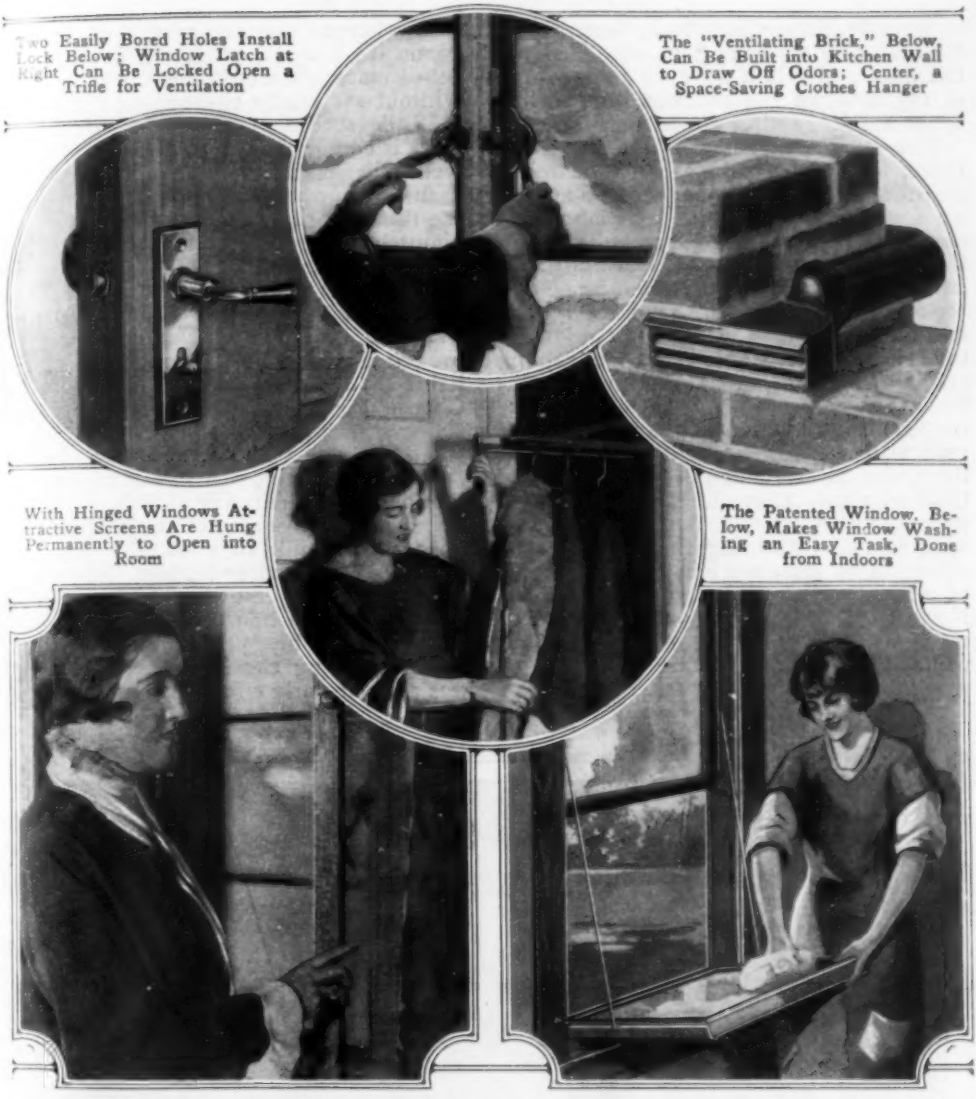
more than wood siding. Brick walls may mean an initial expense of from $400 to $800 more, but give a better fire-insurance rate, eliminate painting and not only are more durable but lessen depreciation. Wood shingles, patent roofing in rolls, or shingles, tile, or real-clay tile can make a roof cost almost any amount. Unpainted shingles are cheapest, those dipped in stain come next, and brush-coated shingles may cost $25 to $50 more. Mr. Jones advises eliminating the porch and similar items and investing the saving in better materials, including roofing. He also advises insulating all exterior wooden walls, particularly in regions of severe winters. The cost may range from $75 to $150.

Built-in kitchen fittings may cost from $100 to $300, and, unless exceptionally well designed, are not so serviceable as a well-built ready-made cabinet, he says. Extra bookcases, wardrobes, china closets and open stairways all cost money, but can be installed later. A built-in refrigerator with waste pipe and platform may cost from $25 to $50 more than a separate ice box not so well equipped.

If all rooms are not needed immediately he advises omitting plaster, finish floor and wood trim in the spare ones until later. Stock moldings, doors, sash and trim cost less than special millwork. Hardwood floors are more expensive than soft, and each grade of hardwood has a different price. There may be a difference of $50 or more between the first and second grades of oak flooring. The medium grades are durable, and, if the millwork is well done, and painting, filling and staining of the right sort, the appearance will be fine. The difference between soft and hardwood trim may be $150 or more. For finish, stain and varnish cost less than paint, the difference amounting perhaps to $100 or more. Mirror doors, plate-glass or double-strength glass windows vary in cost, and careful pricing may mean considerable saving. A clothes chute is not an absolute necessity, and a good metal one will cost $25 or more.

The architects' bureau advises always buying the best plumbing fixtures you can afford, whether vitreous china, iron coated with enamel, or solid porcelain. A saving can be made by picking a design in keeping with the money you can afford to spend. A recess bathtub, for example, will cost $35 to $50 more than a simple leg tub. Solid porcelain lavatories cost more than enameled iron, the latter saving $25 to $50. The "pop-up" type of lavatory waste will cost $3 to $5 more than a simple chain-and-plug device. A kitchen sink, with drain boards or apron cast on, costs more than the plain type, and wood can be used in their place if you want to save. A combination hot-and-cold-water faucet may cost $5 or $6 more than separate ones. Laundry tubs, built in, can be had in a wide range of prices. Hot-water heaters vary, too, and Mr. Jones advises always buying the best you can afford, and likewise the best heating plant your pocketbook will stand. A heat regulator saves time and steps and fuel, but will cost anywhere from $50 to $160, depending upon the type. It can always be added later. Radiator valves, too, have a wide price range. High-type radiators cost less than low type, but only the latter can be fitted under windows. Insulation on heating pipes varies in cost, but good insulation saves on the coal bill.

Finish hardware and electrical fixtures may cost anywhere from two to five per cent of the entire house bill. On a $6,500 house the range between cheaper and expensive grades may be from $130 to $325. For the small home there is a wide range of ideas and devices to save space and money. A new door lock, for example, can be installed by boring only two holes, instead of painstakingly mortising out a section of the door. Even a slow carpenter can install four an hour, cutting down the labor costs. On the side of convenience there are myriad devices. A patented double-hung window may be swung inside so that the outer surface can be washed while standing on the floor inside, eliminating all dangerous climbing. A convenient lavatory can be built into a wall no more than four inches thick, the basin folding up when not in use, while a mirror slides down to cover it. Instead of inconvenient hooks for closets, one firm makes a sliding hanger rail which folds into the closet when not in use, and can be drawn out into the room to give ready access to any article, without taking down everything in front of it. One convenient space saver is a small sleeve board and a large ironing board which are built into the wall, with a door to cover them when not in use, the hinged board folding upward. The whole device—door, casing and all—comes assembled ready to be installed. Instead of expensive tiles for bathroom walls, a new fireproof wallboard made of gypsum can be used. It is impressed with a ceramic tile design and takes a very high enamel finish. For ventilating the kitchen and drawing off odors and foul air, a "ventilating brick" is now being made with an outer surface just the size of an ordinary brick, so it can be built



Two Easily Bored Holes Install Lock Below; Window Latch at Right Can Be Locked Open a Trifle for Ventilation

The "Ventilating Brick," Below, Can Be Built into Kitchen Wall to Draw Off Odors; Center, a Space-Saving Clothes Hanger

With Hinged Windows Attractive Screens Are Hung Permanently to Open into Room

The Patented Window, Below, Makes Window Washing an Easy Task, Done from Indoors

into the wall up near the ceiling. A three-inch pipe runs through the wall into the room. For small families the breakfast nook, or "Pullman," is proving quite popular. A folding table, built out from the wall, and two benches like Pullman seats, can be fitted into a recess off the kitchen. One popular design occupies a space five feet four inches by six feet, and accommodates four people.

To show what heat savings could be made in a properly insulated house, the manufacturers of a wallboard made from the waste pulp of sugar-cane factories, have built a model home from architects' bureau plans in Chicago, and fitted it with temperature - recording devices. The house, one of the most attractive stucco bungalows the bureau has designed, has no basement, the heating plant being located in the kitchen. The exterior walls are lined with the company's product and the interior finished with it, a plaster coating being added in some rooms, while in others the material is left in its natural state. It can be tinted, stained or stenciled, and even made to look like stone, with all the beauty of coloring of fine marble, and the warmth of color of limestone. The model house is practically a vacuum bottle, a principle which is being applied more and more to homes, to keep out heat in summer and cold in winter. Experiments with the material in homes

at Beverly Hills, Calif., have demonstrated that proper insulation will keep out the heat and retain an even temperature at night, when the outdoor temperature drops suddenly after sundown.

The bungalow, which has a big living room, fireplace, entrance patio, bedroom, bathroom, and kitchen, cost $9,835 at Chicago prices for materials and labor. It could be built for considerably less than that in regions where material and labor costs are lower. The labor bill alone was $5,455 and cost of material $4,380. The latter includes such luxuries as ornamental iron-work balconies, red-tile roofing and a decorative brick, tile and stucco-finished fence. Part of the cost of the model house was due to the fact that the rear wall was constructed in three sections, one of brick, one of stucco and the third of weather boarding, all three being over the insulating material. Windows were installed showing the interior construction of each section, for the benefit of visitors who inspect the bungalow. Normal construction would save some money there. The tile roof cost $475, while composition roofing or shingles would be considerably cheaper. Only the highest grade materials were used throughout, whereas cheaper grades of lumber, hardware, fittings, plumbing fixtures and other materials would cut the cost down without materially cheapening the house.

While stucco was used in this house, brick is coming back into general favor for well-built small homes. Long looked on with disfavor because of its lack of beauty, the renaissance of brick has been brought about by a new method of laying, called "skintled" because of its likeness to the way bricks are piled in the kiln for baking. Skintled brickwork is simply laid up with the bricks at odd angles, giving a broken surface whose beauty rests in the lights and shadows resulting from it. Charming effects have been achieved by laying the walls of the lower floor of skintled brick, whitewashed, and the upper story of stucco, with a roof with rough rounded edges imitating thatch.

One of the most attractive skintled-brick houses was built of culls, the defective bricks discarded after baking. The architect chanced to see the refuse heap at the brickyard, and when he asked to buy the culls, was told he could have them for the cost of carting them away. The result was a particularly effective rough wall, resembling field stone more than brick.

The Fireplace Adds Considerably to the Cost of a Home, but on Long Winter Evenings Is Worth It. The Floor in This Living Room Is of Rubber Tile

Linen at Half the Price of Cotton Seen in Improved Flax "Puller"

Linen may be produced at half the price of cotton and flax-growing may become a profitable industry in every state of the union if improved machinery designed under the direction of a mid-western automobile manufacturer, proves successful. The apparatus consists mainly of a "puller" of simple construction and easy to operate that efficiently separates the fiber from the plant, and machinery whereby the thread is converted into cloth in one continuous operation. In addition to these inventions, ways of fertilizing the soil so that flax can be grown successfully year after year are said to have been discovered. The plant can be cultivated in practically every section of this country and in many parts of Canada. An advantage in favor of this crop is that it has no parasite.

Mail-Box Safe for Apartment House Stops Theft and Aids Carrier

Large enough to accommodate magazines and other bulky articles with little trouble, a mail box has been constructed for apartment-house use that is virtually a small steel safe, set in the wall and protected by a master lock the key of which is carried only by the postman. The top part is covered by a single door which drops down when the master lock is released, exposing the separate compartments. The absence of the usual narrow slit makes it easy to put the mail in and there is no opening to allow pilfering with hooks or fingers. Below the main door are separate ones to the boxes. These are opened by individual keys. The safe is made with three, four, five or six units.

Tenant Taking Mail from His Private Box and Carrier Delivering Letters through Wide Upper Door into Individual Compartments

Auto Oil Gauge Lights Signal Lamp to Warn When Supply Is Low

Attached to the drain plug in the crankcase of the automobile engine and electrically connected to the motor and a red signal light on the dash, an automatic oil gauge warns when the supply gets low and stops the engine before damage can be done through burning out the bearings. A series of floats is so arranged that when more oil is needed, an electric contact is made, lighting the signal lamp. This burns until the necessary supply is added. If no lubricant is put in when the light flashes and the floats sink lower, the motor is automatically stopped as an additional precaution.

Automatic Pocket Poultry Killer Insures Proper Bleeding

For killing fowls of all kinds and sizes for the market, a pocket-size device operated somewhat in the same manner as a pair of pincers, is said to insure proper bleeding of the birds and thus increases their market value. It consists of a small sharp blade and a clamp which are squeezed together by pressing the grip with one hand. The blade part is inserted in the chicken's mouth and the other side fits at the back of the head. When the grip is pressed, the veins in the neck are severed. This method is regarded as entirely humane and sanitary.

Safety Brake Fitted on Hand Truck Eliminates Blocking Wheels

To make hauling heavy objects with hand trucks easier and safer, a simple braking attachment has been patented that

Applying the Foot Brake, and View of the Bar, Springs and Bands

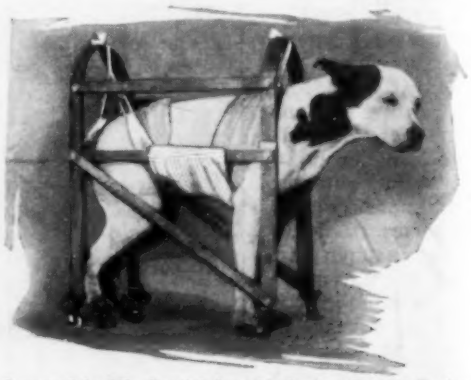
can be put on almost any two-wheeled truck in a few moments. It consists of a pair of brake shoes lined with regulation material, bolted to the sides of the frame and connected with a telescoping cross-bar. Two heavy springs hold the shoes away from the wheels, and friction is applied when wanted by simply placing the foot on the bar. With this attachment, there is little danger of the carrier running back while getting the load on, the aid of a helper can be dispensed with, time is saved in not having to block the wheels, and the workman has both hands and his full weight to apply to the object he is loading.

Speed of Finger and Vocal Muscles Shown in Playing and Speech

The efficiency of the human body is illustrated in hundreds of ways, but the remarkable speed of which the muscles are capable is said to achieve its highest development in the performances of violinists and pianists and in the movements required for ordinary speech. It is estimated that a skilled violin player will execute as many as 600 finger motions per minute, while a pianist playing the "Minute Waltz" must touch 740 keys with his right hand in the same length of time—some artists are able to do it in thirty-five or forty seconds. In talking, the vocal muscles are often called upon to perform twenty-five definite motions in one second. Fast as this rate is, it appears slow when compared to the rapidity of the action of a house fly's wings which are said to make 330 beats a second, probably the world's record for natural flyers.

Crutches on Casters Built for Dog to Help Cure Auto Injury

Paralyzed in the hind limbs as the result of being struck by an automobile, "Sport," a pet dog owned by a Wisconsin man, was pronounced incurable and preparations were made to chloroform him. But an inventive veterinarian heard of the case, designed a roller cage in which "Sport" could push himself about with his forelegs and now the dog is said to be well on the road to recovery. Strips of scrap iron were bent and bolted to form the support, which, when completed, resembled the frame for a small kennel. "Sport's" injured members were held from the floor by means of bandages passed under his body and over the top loops of the cage, where they were tied with strings. The dog was taught to use the contraption by placing him in it before he was given his food, and he would then push himself along to his dish. Now he has learned to bark until he is put into his wheel chair and manages to travel a considerable dis-



Strapped in His Special Invalid Chair, "Sport" Pushes Himself About with His Forelegs

tance each day. The gradual exercise and protection to the injured limbs are working what is expected to be a complete cure.

Copies of Drawings Made to Scale by Dry Photo-Printing Process

True-to-scale copies from tracings of engineering and architectural drawings or similar work may be easily and cheaply made, it is claimed, by a dry photo-printing process which a London firm has announced. The paper is furnished in various thicknesses and is exposed in the same way as the ferro-cyanide kind and for about the same time but requires no subsequent washing or treatment with liquid chemicals. Printing is done in a wooden box fitted with trays below which is placed a dish of liquid ammonia. Fumes rising from this substance act upon the paper in such a way that the image desired is printed in practically black lines on a whitish background. As no stretching or shrinking of the paper, such as occurs in using liquids, is caused by this method, exact copies may be obtained. They are said to be permanent, and in making corrections on the prints, lines can be removed with little trouble with a solution of hypochlorite of soda or a five-per-cent solution of permanganate of potassium.

Daily Trips of Nation's Autos Total Three Hundred Million Miles

Estimates prepared by the federal bureau of roads show that the automobiles in this country make daily runs totaling more than 300,000,000 miles, traveling in two days a greater distance than that covered by all the passenger trains in the United States in a whole year. The figure is based on a report from the department of the interior that 794,030,852 gallons of gasoline were consumed in the month of July last year. It is estimated that at least eighty-five per cent of this amount was used for motor vehicles. On July 1, 15,552,077 autos of all kinds were registered, and it is assumed that fourteen miles to the gallon is a fair estimate of the average performance of each car.

Toy Kitchen Cabinet Has Roll Front and Adds to Value of Play

Modeled closely after the usual-sized article, with a roll front, metal or porcelain top and doors with spring catches, a kitchen cabinet for little girls has been placed on the market to add to the fun of "playing house" and to give instructive value to the child's amusement. The cabinet is finished in durable white, is strongly constructed and of convenient size for the recreation room. It will hold sets of dishes and cooking utensils, or, if desired, other toys may be stored in the bottom lockers.

Little Girl's Figure Illustrates Size of Toy Kitchen Cabinet, Partly Open to Show Shelves and Work Board

Twin Fuse Plug in Standard Size Gives Double Service

Standard-size fuse plugs of "twin" construction so that when one side burns out, it can be turned around and the other end used, have been placed on the market. An insulating wall is placed in the center.

Camera Corps That Filmed Colossal Movie Production; with This Battery of Lenses Recording Every Scene, Miles of Pictured Ribbon Were Harvested for the Director's Selection of Final Reels

Hunting Human "Game" with a Camera

Adventures of Press and Movie News-Reel Photographers Filled with Hair-Raising Experiences as Well as Amusing Episodes

HUNTING in Africa has few thrills to equal those encountered daily by the cameraman seeking human "game" for the newspapers and movie films. Men or women who do not want to be photographed bring all their ingenuity into play to outwit the pursuing picture man, and, if that fails, they sometimes turn and assault the photographer. The elements, too, are in constant battle with the picture taker, who must not only get to the scene of a big story and get his pictures, frequently under extremely adverse conditions, but likewise get them back to the office again.

For real thrills the man who took the first pictures of the Dayton flood in 1913 lived an ordinary lifetime in one day. The relief expedition was stalled six or eight miles from Dayton by a washed-out bridge. The photographer and his assistant had invested in rubber hip boots, and each had a piece of sausage more than two feet long for rations. Tying the sausage around their necks and balancing camera and supplies on their heads, they started to wade eight miles to the city, through water frequently up to their shoulders.

Once arrived, the films were "shot" within a few minutes, and then one set out on the return journey. He found a locomotive and its engineer, twelve miles from Dayton, but no fireman. The photographer brazenly represented himself as a qualified union fireman, and succeeded in buying the engineer's sympathies as well as the use of the locomotive. Once out on the road, his first dozen shovelfuls of coal showed he had never fired a boiler before, but the engineer demonstrated how it should be done and they crept north toward Toledo, where they were met by a mob of newspaper reporters and photographers, all trying to get to Dayton, or get news from it. The photographer with the plates took no chances on having his precious bag stolen and, being dead for sleep, took the precaution of borrowing a pair of handcuffs from the police department, locked the bag to his wrist, and hid the key in his shoe before starting for Chicago. Getting a picture of a celebrity

Snapping Newsy Photos Poised over a City's Canyons

On the Trail of Picture Stories in Mountains of Central Asia

Risking Dangerous Footing to "Shoot" Roof Scenes among Skyscrapers

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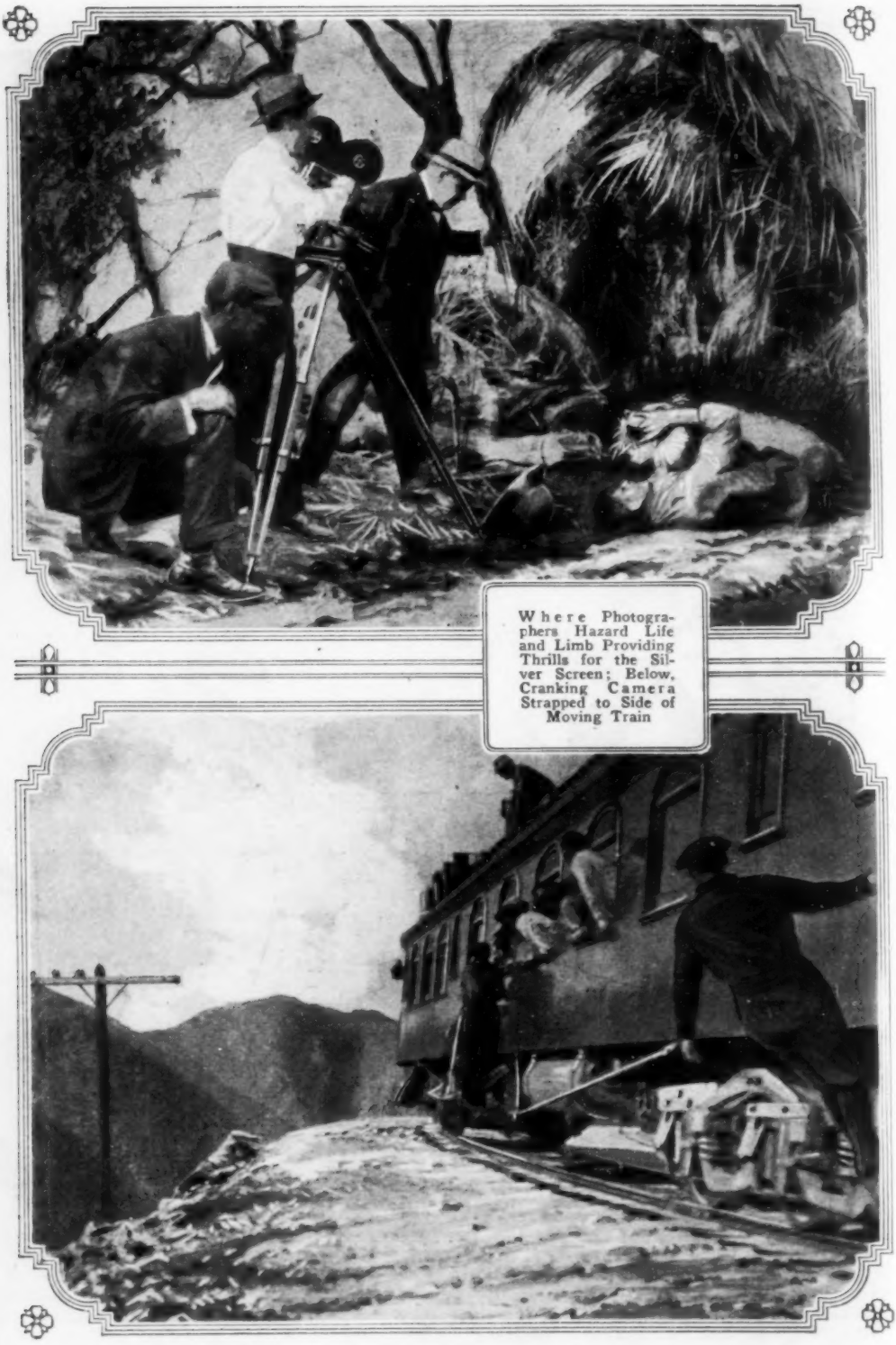
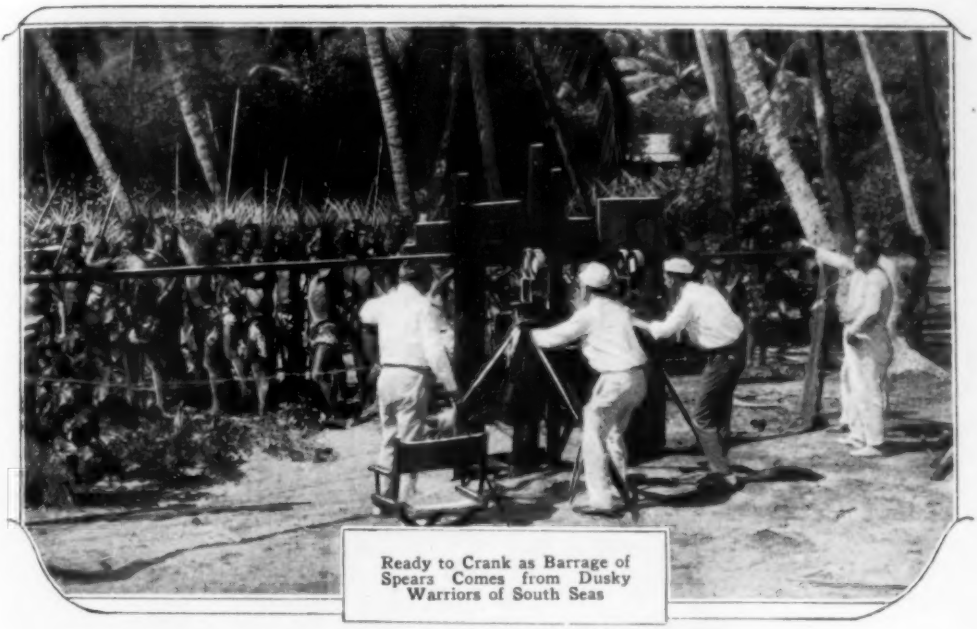


Where Photographers Hazard Life and Limb Providing Thrills for the Silver Screen; Below, Cranking Camera Strapped to Side of Moving Train



Ready to Crank as Barrage of Spears Comes from Dusky Warriors of South Seas

Every Vantage Point Is Used by Cameramen Who Overlook Nothing to Make Good Films

On High Roof in Alaska, Using Semaphore Signals to Direct Action of Players in Filming Movie Scenes

Lying by a Roadside to Get Close Shot While Making a Movie of Speeding Auto Taking Hazardous Curve
Despite Difficulty of Taking Pictures of Aerial Scenes Agile Operators Find Queer Ways to Accomplish the Tasks
News Photographers Dare Any Risks to Get Scoops on Interesting Pictures
© U. & U.

who doesn't want to be photographed is equally hazardous. Several years ago when a certain banker's affairs were occupying public attention he employed several armed bodyguards to keep photographers away. One of the picture men, however, made a study of his habits and found he left his home at the same hour each morning. He then bribed a milk-wagon driver, cut a hole in the canvas side of the wagon, big enough to expose the lens of the camera, and the next morning, as the banker left his home surrounded by his guards, the milk wagon drove slowly past, with the hidden cameraman taking pictures as fast as he could load and shoot.

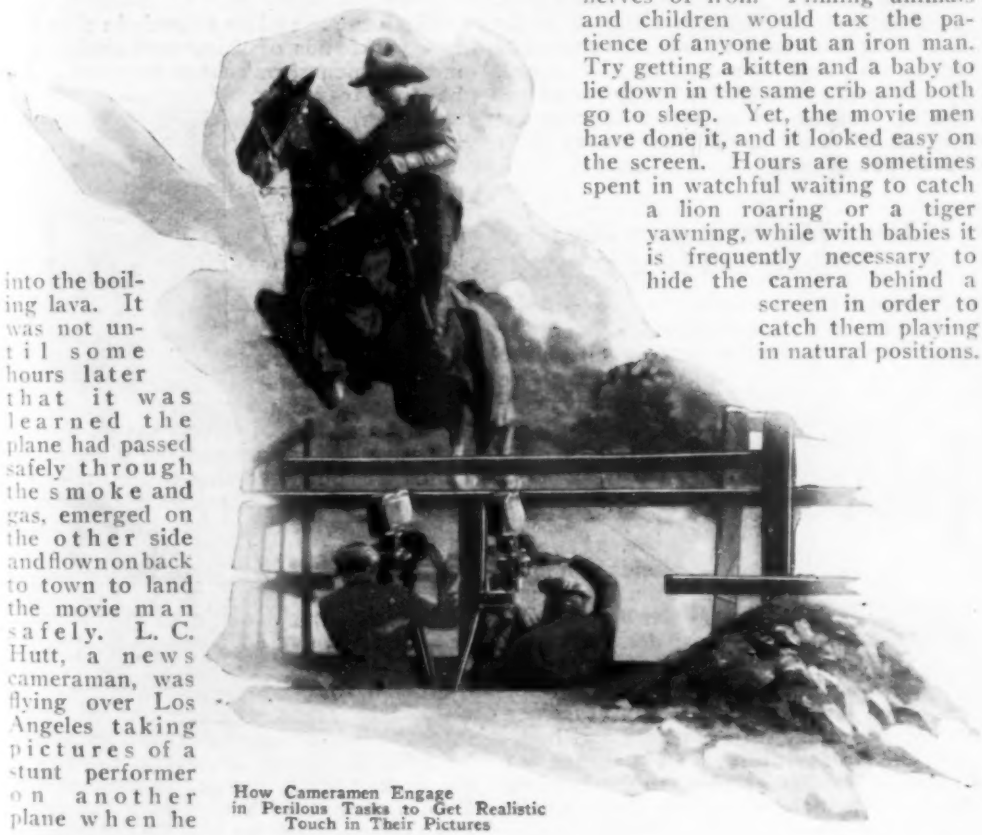
During a divorce hearing some years ago, the defendant, a wealthy man, objected to being photographed on the stand, and his attorneys obtained an order from the court barring photographers. One got past the bailiffs, however, as he did not appear to have a camera with him.

The judge recognized the intruder and called him to the bar, where he repeated the order and threatened to send any offender to jail "for life." When the afternoon edition appeared, spread across the first page was an eight-column layout showing pictures of the judge delivering his warning, the defendant sitting beside the judge in the witness chair, the defendant's wife and attorneys, and then a series showing the bailiffs stationed about the room to keep photographers out. Fortunately for the photographer the court enjoyed the laugh, but asked to be let into the secret of how the man got the pictures while standing at the bar being told not to. The explanation was a small camera and a derby hat with a tiny hole cut in the top to expose the lens. As the photographer stood before the bar he held the hat in both hands against his chest.

The movie news-reel men are always experiencing thrills. Some time ago one flew over Vesuvius in an airplane to film the crater, and when the plane disappeared in clouds of smoke the report spread that he and the aviator had fallen into the boiling lava. It was not until some hours later that it was learned the plane had passed safely through the smoke and gas, emerged on the other side and flown on back to town to land the movie man safely. L. C. Hutt, a news cameraman, was flying over Los Angeles taking pictures of a stunt performer on another plane when he stuck his hand into the propeller, losing three fingers. Instead of telling his pilot of the accident, he tied up the wound with a handkerchief and kept on turning the crank until the assignment was completed. It was not until the film had been rushed to the laboratory and developed that Hutt fainted from loss of blood and it was learned that he had been injured. C. J. Kayo, another news-reel man, was sent into Mexico to get pictures of Villa in the heyday of that bandit's glory. He was caught at it, and Pancho stood him up against the nearest wall and ordered out the firing squad. Before giving the order to shoot, he asked if Kayo had anything to say, and the cameraman replied:

"Yes. Since you don't want pictures of you shown in the United States, I would like to destroy the film of you before I die."

Villa was so touched he ordered Kayo released, and the photographer gravely destroyed a reel of film, but it was an unexposed strip, and he brought back to the United States the first pictures of the bandit leader in his home surroundings. The film man must be a diplomat plus, with nerves of iron. Filming animals and children would tax the patience of anyone but an iron man. Try getting a kitten and a baby to lie down in the same crib and both go to sleep. Yet, the movie men have done it, and it looked easy on the screen. Hours are sometimes spent in watchful waiting to catch a lion roaring or a tiger yawning, while with babies it is frequently necessary to hide the camera behind a screen in order to catch them playing in natural positions.



How Cameramen Engage in Perilous Tasks to Get Realistic Touch in Their Pictures

Tug of War between an Airplane and a Heavy High-Powered Automobile to Determine the Stronger Machine; the Contest Resulted in an Easy Victory for the Flyer

Plane Wins Tug of War with Auto during Contest on Ground

During a tug-of-war contest between a high-powered automobile and an airplane, held at a San Francisco aviation field, the flying machine dragged the car backward for a considerable distance. The plane, with its running gear equipped with four pneumatic-tired wheels, had little difficulty in pulling the heavy vehicle, the engine of which was kept operating at high speed. To make the task harder for the airplane, the automobile, which was a touring car of rather heavy type, was loaded with seven passengers.

Metal Mender Repairs Hose Quickly and Neatly

The mending of steam, water and air hose, usually a troublesome job, is greatly simplified by a mender recently put on the market. The device is made of metal throughout and consists of a nipple that fits into the adjoining ends of a hose and carries two light spiders that may be forced into the surface of the hose. To attach, it is only necessary to slip the nipple into the hose and hammer the spiders down. There are no clamps or projecting parts to catch when the hose is dragged along the ground, and as the nipple ends are short, they do not appreciably affect the flexibility of the tube. The manufacturers claim that the mender will not leak or pull out under the highest pressures.

Collar Button for Tight Neckbands Eases Strain of Shrinkage

With the use of an extended collar button, neckbands of shirts and similar garments which shrink from laundering can be made to fit the wearers without need of cutting buttonholes or replacing the piece. The link is constructed to allow both the collar and shirt to be adjusted comfortably and replaces the shrinkage without injuring the cloth. Neatly designed of strong metal, the devices are said to increase the girth of the bands without distorting the front of the shirt, resulting in the saving of favorite garments which might otherwise be thrown away.

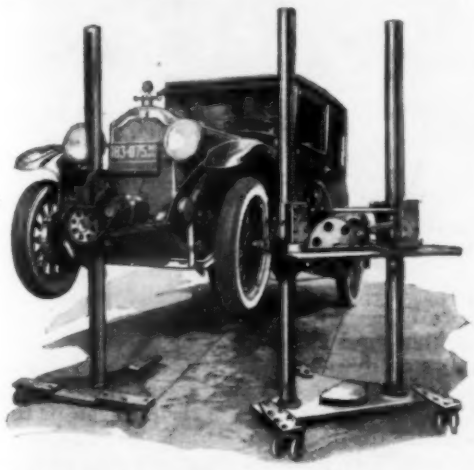
Early Railroad Builders Hold Record with Ten Miles of Track in Day

Not all the high-speed records can be claimed by modern enterprise. Research into the performances of the men who built the first transcontinental railroad in the United States shows that on April 29, 1869, a crew of 8,000 men with five trainloads of material, on the Central Pacific

railroad, laid ten miles of track between dawn and nightfall, a record which is believed not to have been equaled in later days even with improved machinery and skill. In all, this pioneer crew laid about 3,500 rails that day, handling some 1,000 tons of metal with their hands. A pair of rails every thirty seconds and a mile of track in three and one-half hours were considered ordinary performances in those days of romantic trail-breaking across the western plains. It is true that modern equipment is much heavier, and the track was not so solidly ballasted as is customary nowadays, but the comparison is not entirely unfair when it is considered that the workers of fifty-six years ago did almost all the labor with their hands.

Portable Hoists That Climb Poles Save Labor and Storage Space

Electric elevating platforms that climb toothed poles by means of motor-driven gears have been designed to lighten labor and save time and space in garages and storage houses. The hoists are equipped with strong metal rollers so they may be moved about as needed, and can be easily handled by one man. Either end of a car or the entire vehicle can be raised to permit work to be done on the under parts, eliminating the necessity of pits or elevated tracks, while cars can be quickly lifted for double-deck storage arrangement. The platforms which come in contact with loads are constructed to prevent scratching painted surfaces or damaging the machinery of automobiles.



Automobile Hoisted by Portable Pole-Climbing Elevator to Permit Work on the Car's Under Parts

Traffic Policeman Signaling with Illuminated Disk Lighted from Pocket Battery for Night Service

Flashlight Stick for Traffic Police Helps in Signaling at Night

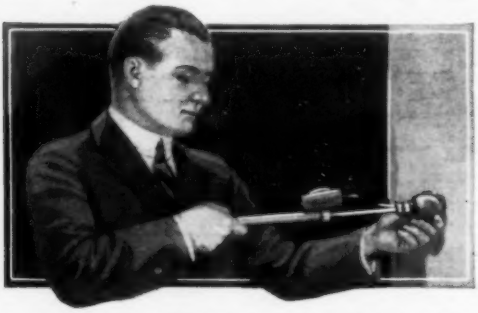
German traffic policemen on night duty are using sticks with an illuminated disk at the end, lighted with current from a pocket battery, to make the "stop" and "go" hand signals more easily visible to motorists and others. The little torch catches the eye at a considerable distance, calling attention to the fact that a policeman is stationed at the intersection, and thus affording an extra warning to drivers who might be tempted to speed by. The stick is as long as a police club and the light is turned on or off at the grip handle.

Tinkling Bells Tied in Toy Balloons Add to Children's Delight

Added enjoyment is afforded children from the toy balloon by a tiny bell attached inside to the stick, where it tinkles musically with the movements of the sphere. The little instrument is so small that it lessens the buoyancy of the globe only slightly, and the bells are also said to increase the effectiveness of toy balloons for advertising purposes.

Fruit Tester Tells Food Inspectors if Products Are Overripe

Pinching apples, pears, and other fruits with the fingers is considered a fair test of their condition, but food inspectors of the



Food Inspector Testing Ripeness of an Apple by Measuring Pressure Required to Bruise It

department of agriculture have a more accurate means of determining if products are too ripe to be fit for shipment or sale. They use a plunger device which measures maturity in pounds. It consists of a small rod within an outer casing containing a steel spring against which the bar rests. One end of the rod is placed against the fruit and the end of the barrel held in the hand. By pushing forward, the pressure on the spring is registered on a graduated scale on the casing. The figures are made easily legible by a small electric bulb which lights automatically when the plunger pierces the skin of the fruit. The amount of force required indicates the condition of the specimen.

"Invisible Hands" to Guide Planes by Electric Cables on Ground

In the belief that the time is not far distant when the recognized air routes will be so thronged with planes and flying craft that the danger of collisions will peril the success of that method of travel, the British royal air force already is seeking a way to steer the ships by means of electric cables laid on the ground directly beneath the paths taken by the air liners. An indicator in the pilot's cabin or in the cockpit, actuated by the electric current, will instantly show any departure from the right course or there will be an automatic device which will put the ship back in line without the pilot's attention. Thus, it is proposed, the craft of the skies will be guided almost as certainly as the steam trains are kept on the track, and all the pilots will have to do will be to keep the motor running smoothly and maintain an even altitude. Such a system, it is believed, would also solve most of the difficulties of flying at night or in fogs.

Lumbermen Put Insects to Work Stripping Bark from Logs

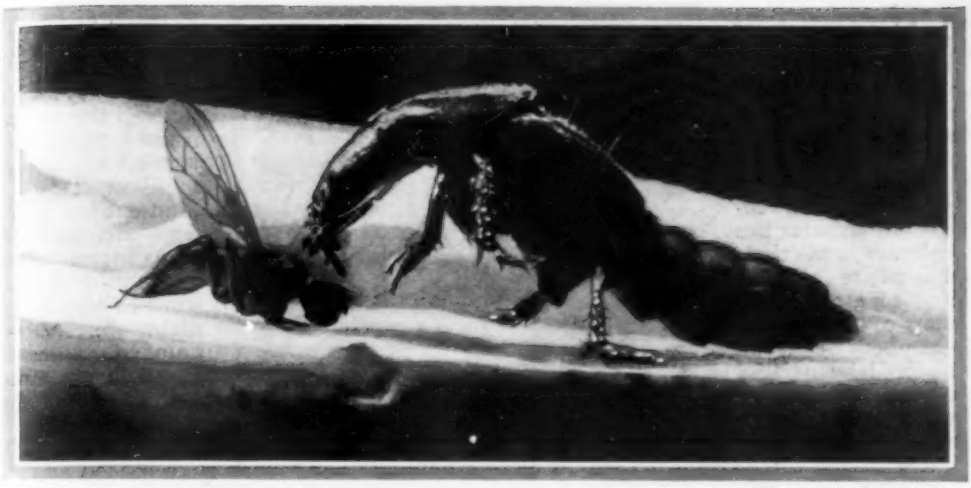
Barking logs cut for paper manufacture is an expensive and important process, for none of the outside material must get into the pulp or it will spoil the quality of the finished product. The cost of this work has been reduced by a southern company, according to reports, by girdling the trees in the late summer, thus attracting beetles and other wood-boring insects that so completely loosen the bark by the time the tree is to be felled, that it can be stripped off with but little difficulty. In Burma, the natives have used ants in this way to remove the bark from sandalwood for export.

Screw with Square Niche in Head Prevents Driver Slipping Off

Screwdrivers as well as screw heads are damaged frequently, especially when working with hard woods, as the tool can-

Square-End Driver and Screws, with Slots to Fit, for Inserting in Hard Woods

not get a satisfactory hold in the usual type of slot. This difficulty has been overcome in a screw with a deep, square recess in the top. It is driven with a special screwdriver shaped to fit tightly in the niche, the end tapered slightly to assure a firm grip. It is claimed that screws of this kind can be put in or withdrawn more easily than the usual style, and there is little danger of the driver slipping out, thus preventing damage to the head or to the surface of the wood. With the square recess, it is possible to make the screw heads smaller and put screws more closely together.



Courtesy of The Ill. London News

Dragon of the Insect World; a Rove Beetle Devouring a Fly, One of the Many Tragedies That Take Place in an Almost Hidden Life Now Revealed by Movies

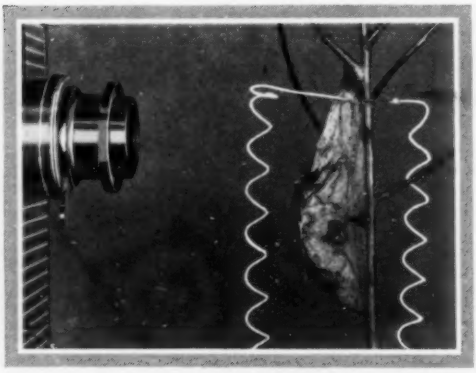
Insect Toilers Revealed by Movies

Trapdoor Spiders, Mud-Daubing Wasps and Queer Diving Beetles Shown as Tiny Workers of Hidden World

THAT insect life is filled with tiny masons, architects and workers which appear to construct their homes with mathematical precision has been shown by motion pictures revealing the mysteries of an almost hidden world in marvelous "dramas" staged in the haunts of winged and crawling little creatures. Cameramen who photograph such scenes are often required to spend weeks and months of tireless effort and patient waiting to get the stories of the careers and habits of the elusive "actors." Lenses that magnify the subjects to several times their natural size disclose minute monstrosities rivaling in ugliness the armored giant lizards attributed to a prehistoric age. And many of the more familiar insects, once thought to be harmful to man, are shown in reality to be the deadly enemies of pests that often wreak havoc to crops and animal life. To photograph the activities of a trapdoor spider, a cameraman spent more than seven weeks filming the busy little worker as it hustled about the opening to a home it was constructing in the soil. Having built a tunnel into the earth, it lined the interior with smooth, hard clay, and closed the outlet with a perfectly formed trapdoor of mud and silk fibers that fitted the hole as snugly as a stopper in a bottle. To this door a hinge was attached so the occupant of the underground den could swing the cover back and forth. Then there are the diving beetles and the boatman beetles and others that go about burying small dead animals and birds in graves they dig beneath the bodies so they will slowly sink into the cavity

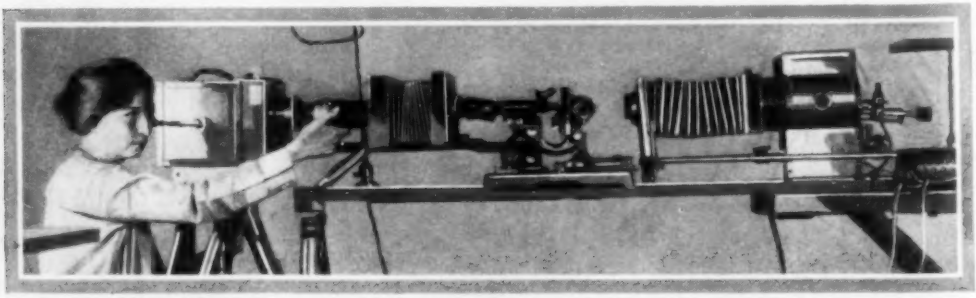
Examining a Tadpole "Actor" Which Has Been Stolen from Its Native Haunts for Filming

and disappear from sight. Army ants in all their splendidly organized existence are magnified for the screen only after much preparation on the part of the "director" to transfer the colonies and their moundlike homes so the intricate mass of tunnels and chambers can be bisected by a glass panel through which the insects may be watched undisturbed while they hurry about the various duties of provisioning food stores and caring for the young. For night-flying bugs, caterpillars and moths which do their work silently under cover of darkness, special lights are used and arranged so the rays are partially concealed to avoid frightening the little toilers while the camera is registering their every movement. For the more wary victims of the lens, much time is devoted by the operator in making the subjects accustomed to his presence and the noise of the machine. Honey and similar tempting feeds are placed in the vicinity of webs, holes, crevices and other abodes of the insects. Meanwhile the camera is set up to command a view of the surroundings and turned while the subjects can see it. Only when the bug or fly seems to appear content with the presence of the operator and the apparatus are actual pictures attempted. Life stories of butterflies, toads, beetles and many other tiny subjects have been filmed for the movies by Miss Lucile Berg in a Chicago studio. A miniature garden with small sunken pools and flowers has been set up in which the insects can live in a natural state while the photographs are being made. Frequently,



Powerful Camera Lens Focused on Colony of Wasps Ready to Register Their Busy Movements

to catch one of the captives in some rare situation, the operator is required to keep the camera trained on the subject all night long for days at a time. Mud-dauber wasps, tiny architects of the insect world which do their work of building at night, were photographed while engaged in plastering a clay home beneath the rafters of an old barn. The lights used for the photographing work were hidden and the rays reflected to the spot by a series of mirrors. Trips to out-of-the-way places have to be made to film interesting insects which could not be transplanted to inclosures for the purpose, and long night vigils are kept with camera ready to catch the wary ones in the midst of interesting activities. For the making of a film containing a motion-picture story of the mosquito's life, tiny glass tanks were filled with water and the larvæ permitted to swim about the narrow space. When the camera was set up and lights turned on, it was found the heat of the lamps evaporated the water and sometimes caused the death of the inmates. A system of replenishing the reservoir with a drop or two of water every few moments was worked, and the drama proceeded smoothly. Despite beliefs held by many concerning the harmful habits of hundreds of insects the movies disclose them to be innocent of most of the damage they are charged with. Spiders, though found to be armed with hideous weapons, have been proved to prey only on those insects which are said to be doing great injury to vegetation and animal life.



Getting a Magnified Close-Up of a Group of Mosquitoes, Where Great Care Must Be Used to Show Accurately the Working of the Insects' Delicate Weapons

Ribs on Bottom of Cooking Utensils Utilize More Heat and Save Gas

By adding a series of metal ribs or vanes radiating from the center of the bottom of cooking utensils to the outer edge, engineers are reported to have found a design which may be made to save sixty per cent of the gas used by a plain-bottomed vessel of the same size. At a test with a copper container, this style absorbed nearly two and one-half times as much heat as an ordinary pot. While this addition to the flame contact area is especially suited to gas flames, the design is said to effect corresponding savings with any kind of fuel and can be adapted to a wide variety of equipment.

Wrench Adjusted by Push of Thumb without Bother of Screwing

Adjusted by merely pushing the lower jaw up or down with the thumb instead of having to turn a screw arrangement, a wrench now on the market saves time and is said to fit tightly and without slipping. The jaws are placed at an angle of about twenty degrees, a variation from the usual right-angle position, and when pressure is applied to the handle, the lower-jaw band becomes fastened in one of the niches on the back of the wrench. It is claimed that adjustments can be made in about one-sixth of the time required with the usual screw wrench.

Blown-Glass Trimmings on Gowns Produce Colors of Rainbow

Covered with tiny bits of glass blown to the texture of thistledown, "heart of light" dresses have made their appearance in London society circles where they have attracted wide attention because of their luster and brilliance. The little pieces act as small prisms, splitting the light into the primary colors and giving the garment a dazzling rainbow effect, it is reported. Because of their light weight, they can be used on filmy evening gowns in preference to spangles of glass or metal.

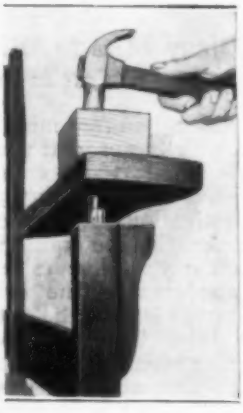
Model of Auto in Bottle Proves Skill of Whittler

Complete in every visible detail, an automobile has been shaped from wood and then cut into tiny bits and reconstructed inside a bottle by a Philadelphia carver. The car is an inclosed model and contains two miniature figures. It is sealed into its strange garage by a wooden stopper.

Carver Holding Bottle Containing Automobile That He Shaped from Wood and Placed inside Glass

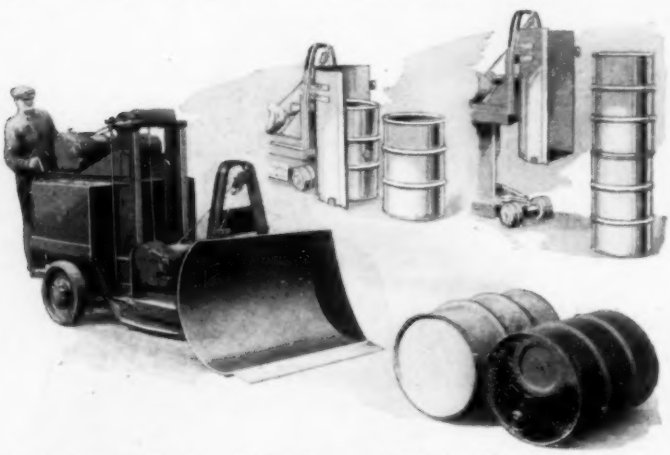
Fasteners for Loose Chair Rungs Make Repairing Easy

Holders that require neither nails nor glue may be used to fasten chair rungs or parts which pull out of their sockets. Once in place, the devices are claimed to hold the pieces permanently. They may also be employed to repair the handles of mops, mallets and brushes, which often work loose from their holes. The rung fasteners are made in several sizes to fit most needs, and can be applied in a few minutes without many tools or skilled workmanship.



Electric Truck That Hauls and Piles Reduces Warehouse Labor

Heavy rolls, boxes and other bulky articles are quickly hauled about and stacked in piles with a combination electric truck and elevator an eastern company has devised to save time and labor in the warehouse. The load is picked up from the floor in an apronlike scoop which is revolved and raised to place the object in an upright position for piling. Both the hoisting apparatus and the truck itself are controlled by one operator, power being supplied from storage batteries. This machine eliminates double handling of goods, the use of block and tackle, reduces the likelihood of accidents and enables the full utilization of available storage space.



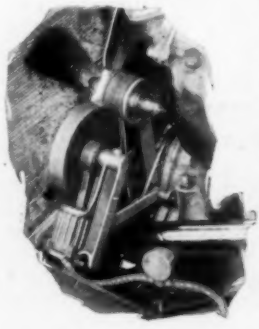
Truck Scooping Up Barrels from Floor, and Sketches Illustrating How Elevator Tips and Piles Them on End

Dizzy Mice in Whirling Cage Used to Test Heredity Laws

Two hundred mice living a dizzy life in a whirling cage at the University of Minnesota, recently completed the first ten years of a twenty-year service in an investigation as to whether acquired characteristics are transmitted from parent to offspring. The mice are the lineal descendants of the original group which started life in the rotating cage on Dec. 6, 1914. The test is being made to determine whether Weisman, originator of the law that acquired characteristics are not transmitted, is correct. Dr. Karl Lashley, of the university and Prof. Charles P. Sigerfoos, head of the biology department, believe Weisman was right. When the first mice were placed in the cage they were dizzy for days and could scarcely stand. Gradually they grew used to the motion and settled down to enjoy life and raise large families. The young ones, born in the revolving cage, were accustomed to it from the start and experienced no inconvenience, but when taken out and placed on a stationary floor, they were as wabbly as seasick passengers when they first reach land. Their children, however, born outside the cage, were normal mice. The inmates of the cage have been kept down to two hundred by removing the surplus from time to time, and in every case those removed have shown that the acquired taste for a revolving home is not transmitted to the offspring. The experiment, however, will be continued until Dec. 6, 1934. The Weisman law, if upheld, would prove that negroes are not black because they have been sunburned through countless generations, passing the characteristic on from father to son, but that they are a big race in Africa simply because they are adapted to the climate.

Air Pump Run by Fan Belt of Auto Makes Inflating Tires Easy

Constructed so that it can be attached to an automobile engine in a few moments, an air pump has been patented to save time and labor in blowing up the tires. When it is to be used, it is slipped over a special bracket which remains fixed to the frame of the car and is held against the fan belt. On the twelve-foot hose running to the wheels, in a convenient position for reading, is an air pressure gauge. The pump is built of durable materials and has simple parts. When not in use it may be taken off and placed in the tool box.



Two Warships Scrapped by Treaty Furnish City Electric Power

Turning swords into plowshares is a familiar figure of speech, but engineers have recently gone beyond this by converting old battleships into machinery to light a city. The steel hulks of the cruiser "Brooklyn," of Santiago fame, and the new battleship "Montana" have been cut up by gas torches and sold to steel mills. There they have been converted into castings and plates for the turbines and tunnel reinforcement a power company uses to supply electricity to San Francisco and surrounding territory.

Siren to Warn of Prisoner Escapes Heard Three Miles

An electric siren, similar to those used during the war to warn of gas attacks, has been installed on a tower in the yard of the Eastern penitentiary at Philadelphia to notify prison guards and others in the neighborhood of a convict's escape. The signal, which can be plainly heard over a radius of three miles, is expected to prevent successful flights of prisoners. By warning the people in the vicinity of the institution at the instant a jail break is discovered, watches can be immediately set upon the routes most likely to be taken by the criminals, and pursuers may be kept informed of the whereabouts of their quarry and the direction in which he travels.

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When a Prisoner Escapes, Electric Siren with Voice of Three-Mile Range Shrieks from This Tower

Magnifier Typewriter Copyholder Spares Eyes and Saves Time

Eye strain and loss of time in typing are said to be avoided with an attachment for the typewriter that magnifies both the stenographer's notes and the page being written. It consists of a holder that can be spaced a line at a time and a reading glass on an extension bracket, so arranged that it can be swung to one side when not needed. The copy is securely held behind a wide panel so that the characters are easily read and the operator need not glance to one side nor is she likely to lose the place.

Inventor with Typewriter Fitted with Copyholder, Magnifier and Front Extension Reading Glass

Area of State Is Increased by River Depositing Soil at Mouth

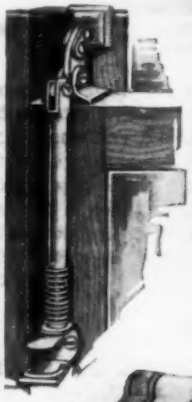
While other states are progressing in many lines, Louisiana boasts the distinction of being the only one in the union that is actually increasing in area. In the last twenty-five years, it is estimated, more than 1,000 square miles of land have been added to the borders of that commonwealth by deposits of the Mississippi river. An aerial survey shows that one sector of the shore line is twelve miles farther out to sea than it was in 1900. Several bays and lakes have been completely filled in and a number of bayous and streams have disappeared. Grass and young trees are now growing where a few years ago, the water was from five to sixty or more feet deep. The building of drainage systems and the clearing of lands have greatly increased the amount of the silt deposits in recent years, engineers say.

Time and Money-Saving Tools

Cores Are Lifted Out of Grapefruit Neatly and Easily with One "Bite" of Clamp Cutter at Left

Holder at Right for Closet Hook, Contains Disk of Effective Moth Killer

Spring-Catch Release Fits on Window to Hold Sash at Any Height



Tight-Fitting Glass "Cork" for Milk Bottle, Which Replaces Paper Cap and Can Be Sterilized

Fourteen-Piece Electric Cooker Has a Thermometer in Lid

Here's a Sturdy Dust Cloth with Built-In Roomy Glove to Keep the Hands Clean

Two Articles Can Be Baked at Once in This Double-Compartment Glass Dish That Saves Extra Washing

A Lifting Rack in This Capacious Boiler Makes It Easy to Remove Contents and Saves Draining Off the Water

Anyone wishing further information on devices described in the editorial pages can

for Woman's Workshop in Home

With Handy Rack, Electric Iron Makes a Small Stove and Can Be Used for Steaming Cloth
Jug Pitcher with Gutter in Spout, Prevents Drips on Table Linen
Cooky "Gun" and Some of the Molds for Cutting Fancy Shapes by Turning Crank
Lock and Burglar-Alarm Bell Combined in Door Prop
Cabinet Washes and Rinses Dishes in Large or Small Quantities
An Oven Shovel for Lifting Out Pots and Pans Saves Stooping Over and Burning Fingers
Egg Cooker
Electric Egg Cooker Does Them Just Right with Steam, Can Hold Four Eggs and Requires Little Current
Revolving Rack for the Oven Saves Burns and Trouble in Turning Cakes and Pies

obtain it by addressing Bureau of Information, Popular Mechanics Magazine, Chicago.

Sidecar Attached to Child's Cycle Enables Two to Ride at Once

Two children can ride at once and, at the same time, have the fun of imitating

Fun from the Cycle Car Is Doubled with Side Attachment That Holds a Playmate

their elders in a cycle with a sidecar attachment similar to those on motor equipment. The toy is a development of the three-wheeled car that has been on the market for some time. It is sturdily constructed, has rubber tires and wide pedals and, besides the sport of riding it, the child in the "driver's" seat gets the extra exercise of furnishing the additional power needed for carrying the passenger.

Diamonds in Building Skyscrapers Replace Tools of Steel

In planning skyscrapers and big bridges the solidity of the earth foundations is now tested by diamond-tipped drills which "feel" their way into rock and soil strata far beneath the surface, revealing the nature of the ground. Immense saws replacing many of the hammers and chisels of stone workers are toothed with the gems in the rough, forming a cutting edge that cleaves blocks of hardest rock as easily as wood. The stones used for this purpose are generally of the white variety, too tough for jewelry, and are mostly found as lumps in diamond strata similar to knots in lumber. Those employed for sounding the earth are black and are mined from beds of rivers and streams. When mounted in tools the diamonds are fitted in settings of steel and copper. Though they wear down with use, the gems can be removed and turned to expose other points. It is said the precious stones are now utilized in almost all machinery devoted to making the most common articles of commerce and for directly cutting such materials as rubber, cotton rolls, and substances of hard and gritty nature.

Growing Scarcity of White Horses Perils Supply of Violin Bows

Makers of violin bows are reported becoming anxious over the growing scarcity of white horses, the source of supply for the long, smooth hairs used in the manufacture of the bows. The shortage is said to be especially marked in Siberia and Russia where the best supplies are obtained, and no suitable substitute for the hair has been found. Silk and metal have been found satisfactory in place of gut strings for the instruments but cannot be used on the bows.

Heater and Strainer for Motor Oil Utilizes Exhaust Gases

To eliminate lubricating troubles in cold weather, a western inventor has patented a combination heating and straining attachment for the motor that utilizes the exhaust gases to keep the oil fluid and in working condition. The strainer is inserted in the auto crankcase, and to this is fitted the heating unit, which, in turn, is connected to the manifold with a length

Oil Heater and Strainer as Attached to the Motor; Parts in Foreground

of flexible piping. The exhaust is applied by simply opening a small valve and is said to keep the oil working easily through the filter screen and the engine in the coldest weather.

Kitchen Range Using "Near-Coal" to Reduce Household Expenses

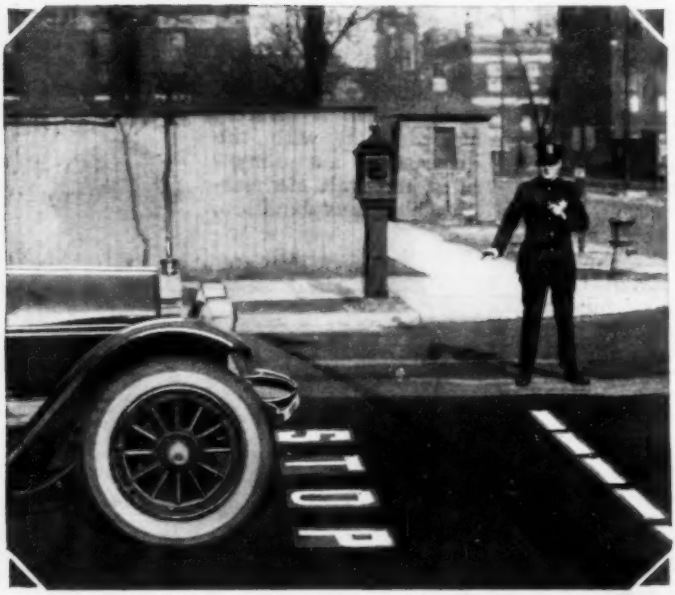
In a process for making a cheap and practicable fuel out of lignite, the woody "near-coal" material that is found in great abundance in many parts of the United States, and in a special kitchen range that will burn the product, hope is seen for reduction of coal bills in the home and for a substantial addition to the country's fuel resources. It is estimated that there are more than a thousand billion tons of lignite within our borders. In its natural state, it is moist and has practically no value as a cooking fuel. Engineers of the bureau of mines, however, have discovered a way to carbonize it in a special oven, producing a charcoal which is said to have the heating equivalent of anthracite. It can be made up into briquettes for easy handling and burns readily in stoves or furnaces equipped with special grates and feeding devices. A kitchen range that German inventors have made to consume the so-called brown coal found in that country, is regarded as the best equipment yet devised for putting the lignite charcoal to actual service. It is fitted with special sliding grates of novel shape, an arrangement for thorough ignition of the fuel, and is said to have given satisfactory results under a number of tests.

Testing Ignition Point of Lignite Spread on Special Grates, and View of Exterior of Stove

¶Celluloid films for use in connection with X-ray studies and so thin that 254,000 of them could be packed into a space an inch thick, have been produced.

Breed Hens That Don't Cross Road to Reduce Loss by Autos

While the reason a chicken crosses the road is still a mystery, poultrymen are agreed that, with the increase in automobiles, the trait, no matter what its explanation, is responsible for thousands of dollars' loss to them annually and that protective steps are necessary. One method has been to remove the pens to points distant from all roads and keep the fowls within the inclosures. Another solution, however, has been offered as a result of tests with different kinds of hens. The experiments showed that the road-crossing tendency is more marked in certain breeds than in others and that raising only the varieties that "stay put" may greatly reduce the annual loss by cars. Out of 100 flocks of a certain breed, only half a dozen chickens went across the road, while with others, all but about the same number tried to dash in front of automobiles to the opposite side. Some farmers are already turning to the varieties that seem to be content to remain on their own side of the highway in an effort to cut down killings, estimated as high as one-fourth of the flocks.



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Tile Traffic Sign at Intersection Stands Out Sharply against Dark Pavement as Plain Warning to Approaching Motorist

Tile Traffic Signs in Street Paving Keep Bright and Attractive

Large traffic signs of white-tile letters imbedded in the asphalt paving at a street intersection in Chicago are being used to replace painted signals to save repeated retouching made necessary by wear of weather and steady streams of vehicles. Since the surfaces of the material are smooth at all times, it is believed the markers attract the eyes of motorists much more readily than the painted ones. A large crew of workers is necessary to replace the painted guides which are easily effaced by a few days of heavy traffic. It is expected the tile blocks will result in a great saving in materials besides affording more conspicuous signals than older methods.

By 1926, 20,000,000 motor vehicles will be in service in the United States, according to predictions of Thomas H. MacDonald, chief of the federal bureau of roads.

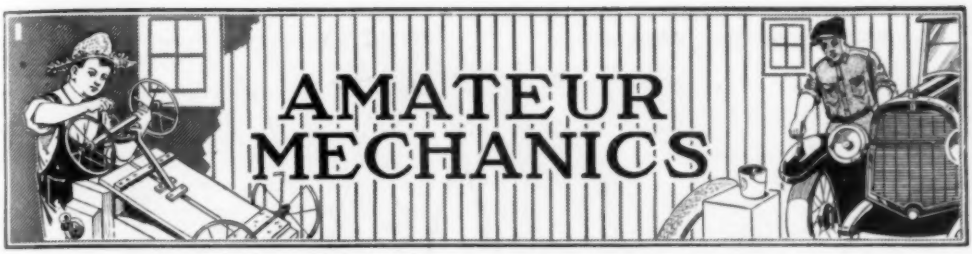
Salvaged Sawdust Used for Walls

Long considered a waste product good for little else besides use in the circus ring or for preserving ice, sawdust is now being elevated to a position of considerable commercial importance by modern science. Grinding and pressing processes have been discovered whereby this material is made into small blocks suitable for flooring, and mixed with asbestos, it has been found valuable in the manufacture of wall covering for both the interior and exterior of buildings. Many mills use it for fuel along with scrap boards and bark, and recently, experiments have been made in cooking it down and extracting alcohol from it. Waste from the lumber milled in 1921 alone, it is estimated, would have produced 185,000,000 gallons of alcohol, valued at approximately $100,000,000.

Revolving Incubator Turns Eggs and Controls Moisture

Turning eggs in a large revolving incubator is accomplished by means of an electric motor which rotates the cabinet. The trays are so arranged that the contents cannot be rolled from their original positions during the operation. Ventilation is regulated by openings on the sides and lower section of the case, and can be changed when necessary without affecting the interior temperature. A device resembling an engine grease cup, installed on the top, automatically adjusts the supply of moisture and is controlled by the humidity of the air.

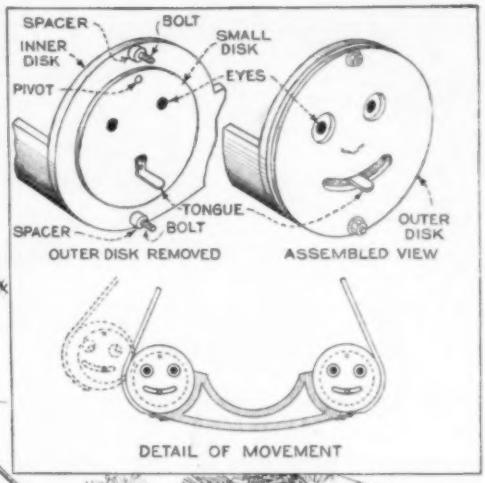
Revolving Incubator in Its Frame with Moisture-Supply Cup at Top of Lid

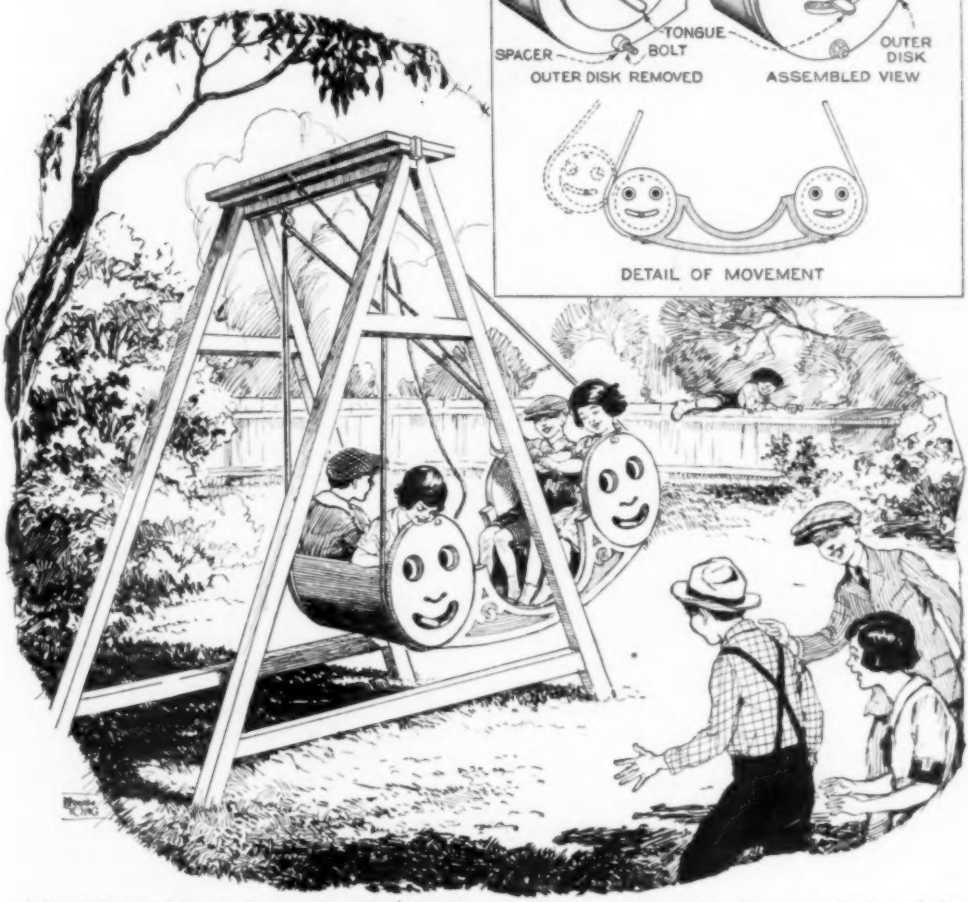


How to Make a Venetian Swing

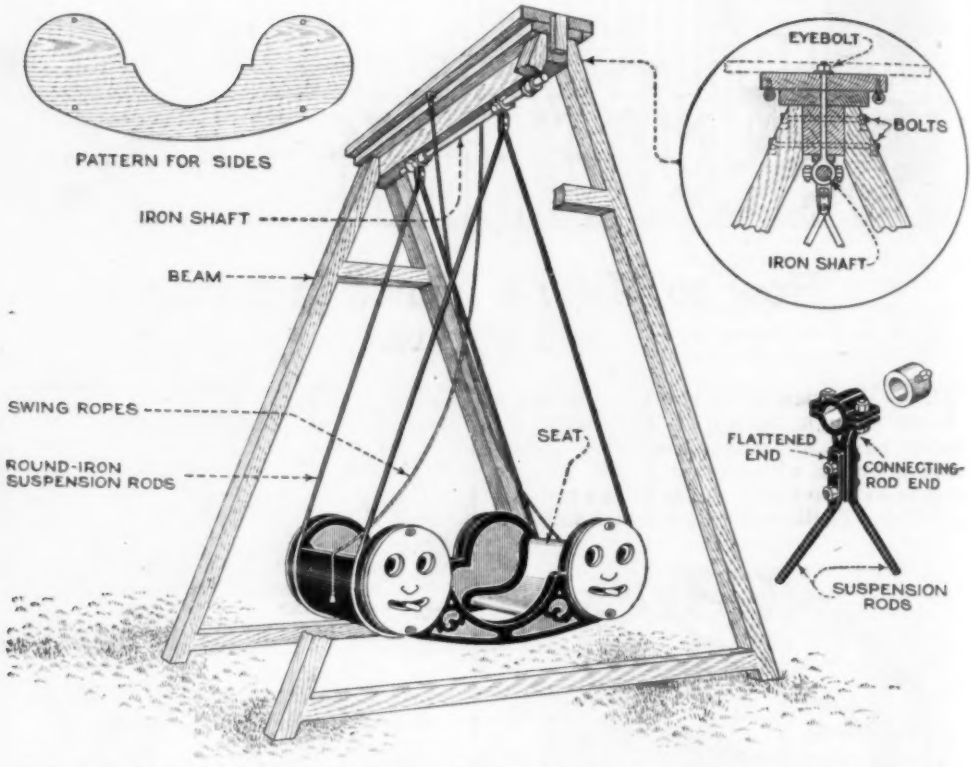
By E. F. PRADER

THE Venetian or gondola swing is an old enough feature of amusement in public parks, but it is seldom used in private grounds, although it is not by any means hard to build, and is ideal for small children. Built properly, it will stand any





A Novel Swing of Simple Construction, That Will Keep the Youngsters Amused for Hours at a Stretch: It Is Quite Safe for Small Children, and May Be Made of Any Desired Size. When the Swing Is Operated the Eyes Roll and the Tongues Loll from Side to Side in a Realistic Manner



Upper Left, Pattern of Sides; Upper Right, Detail of Suspension; Center, Assembly Drawing, Showing Frame Construction, and Right, Method of Fastening Suspension Rods to Connecting-Rod End

amount of abuse, and the high sides of the gondola or car make it safe for the little ones. The design shown in the illustration has, moreover, an interesting feature that makes it a prime favorite with the children. The sides of the gondola have four disks painted to represent faces, the eyes of which roll and the tongues loll from side to side as the car swings.

The construction is simple. A pattern for the sides of the car, which may be of any size desired, is given in the detail drawing. The ends are perfectly circular, and four disks of the same size as the ends are cut at the same time, from the same material. Four smaller disks, about 3 or 4 in. less in diameter, may also be cut. A large disk is fitted to each end, as shown, by means of bolts, with spacers slipped over them so as to leave room for the smaller disks to work between. The outer disks may then be laid aside, the smaller ones centered on the ends of the car sides, and pivoted to them, either with heavy screws or with bolts, after which the position of the tongues may be marked on them. Two holes for the eyes are then bored in each of the larger disks, the location and length of the tongue slots or mouths marked, and the disks slotted.

The tongues are simply strips of flat iron, bent and screwed to the inner disks and painted red. The eyes on the disks are merely large black dots. When the swing is operated, the inner disks swing from side to side, the length of the swing being governed by the length of the mouth slots.

The car is suspended by means of four ⅜ or ½-in. iron rods. These are flattened at the bottom, bent to conform to the shape of the car, and screwed in place. They are also flattened at the top, bent, drilled and bolted to the cut-off ends of two old auto-engine connecting rods, and these are mounted on a shaft of proper size, secured by means of eyebolts to the crossbar of the swing frame. Collars should be provided at each end of the shaft, and on either side of the connecting rods, to prevent endwise motion.

The frame needs no description, but the method of operating the swing may perhaps be new to many. The top board of the frame cross member is made as wide and as stout as possible, and from it two

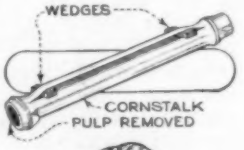
ropes are hung, in the center, and reaching down to the car. The ropes are crossed, and the occupants of the seats, by pulling the ropes alternately, set it in motion and keep it going. Of course, the farther apart the ropes are at the top, the easier it is to start and operate the swing, so an additional length of 2 by 4-in. lumber may be bolted at right angles to the upper frame cross member, as indicated by the dotted lines in the detail, and the ropes attached to the ends of this.

Simple Toy-Balloon Trick

An amusing trick, which can be "put over" without any elaborate equipment, is as follows: Obtain in advance two ordinary toy rubber balloons of contrasting colors, and insert one in the other. When inflated the balloons present the appearance of a single balloon. The performer then announces that he is going to change the color of the balloon instantaneously. He pierces the outer balloon, at a spot where there is a space between the outer and the inner one. The outer balloon disappears with a loud report, leaving the inner balloon in full sight. The effect is startling and amusing, giving the delusion of having the balloon change color.—J. Joseph Alpine, South Amboy, N. J.

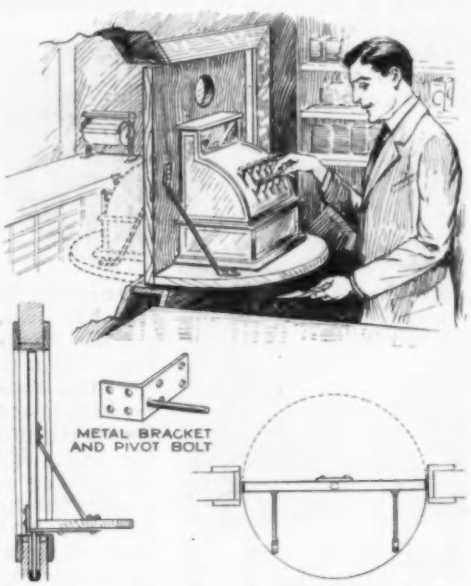
Cornstalk Noise Maker

For holiday and other celebrations where the youngsters like to make lots of noise, a simple and inexpensive noise producer can be made from two short lengths of dried cornstalk. The lengths should have solid joints at both ends and the pulp is removed from both. Then the blade of a sharp knife is inserted under the outer skin just below one joint and two slits are made to the other end. Small wooden wedges are then inserted under the strip thus formed, as indicated in the detail. The strip on each piece is rubbed with rosin, as is done on a violin bow. By rubbing the strips on both pieces of cornstalk together considerable noise can be made.—A. C. Cole, Chicago, Ill.



Double-Duty Cash Register

In a country hardware store a small radio department was opened and a partition erected to separate this section from the rest of the store. As the owner did not feel justified in purchasing a separate cash register for the new department, he devised the plan illustrated, which made it possible to use one cash register on both sides of the partition. A square section, a little higher and wider than the cash register, was cut out of the partition and the opening finished with casing. The bottom of the opening was desk-high, and a wooden panel was fitted loosely in this opening. A semicircular shelf was fitted to the panel at the bottom and was supported by two iron-rod braces, as indicated, and a peephole, about 3 in. in diameter, was cut through the panel just above the top of the register. This allowed a clerk on one side to see whether or not a clerk on the other side was using the register. A hole was drilled in the center of the bottom casing to hold a socket for a strong pivot bolt, which was welded to a metal bracket, screwed to the panel and shelf as indicated in the detail. This permitted the panel to be swung around freely. It is a good idea to fit a bolt also in the upper casing to give the arrangement greater stability and permit it to be turned more easily.—L. B. Robbins, Harwich, Mass.



Pivoted Table Enables One Cash Register to Be Used in Two Sections of Store

Holder for Hot Curling Iron

An electric curling iron is rather a nuisance when used at a dressing table, as it cannot be set down on the table without ruining the varnish, and the same applies to almost all other articles of furniture in the bedroom, yet the dressing table is the most convenient place for making up the hair. By providing a simple holder for the hot iron all danger of marring the surface is eliminatedand curling the hair facilitated. The holder consists of a length of heavy wire, twisted and bent as shown in the insert in the illustration, and screwed to the under edge of one of the side panels, as shown in the larger view. The iron may be dropped into the holder in an instant and is still convenient to the hand when needed. The attachment may also be fastened to the mirror frame.—Dr. R. S. Hall, McLeansboro, Ill.

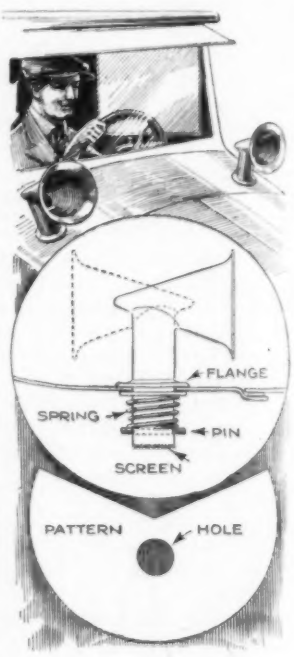
Getting Rid of Ants

There are several ways to get rid of ant hills, and to discourage ants from making nests in the lawn. One method is to pour boiling water on the hill in sufficient quantities to penetrate to quite a depth. Repeat this operation several times. Another method is to pour enough kerosene into and around the nest to saturate the ground. Still another way is to scoop off the top of the nest and cover the depression thickly with powdered borax.

One of the best and simplest methods of dealing with ants is to beat the hill down flat with a heavy maul. One of my neighbors rid his lawn entirely of the pests in this way. He made a maul by taking a round piece of wood, about 16 in. long and 8 or 9 in. in diameter. Into the end of this block of wood, he inserted a handle. With this maul he could pound the ground down firmly, and pack it so hard that even an ant would be discouraged. He made a practice of noting the location of ant hills on his lawn, and right after a rain shower he was busy with his maul. In a surprisingly short time there was no evidence of ant hills at all. In a dry season, the same result can be obtained with a maul by pouring two or three pails of water on the hill before tamping. It appears that this method of treatment packs the ground so closely that the ants are smothered. The advantage is that the grass is not harmed in the least by the treatment.—A. G. Meating, Appleton, Wis.

Ship-Type Ventilators for Auto

For ventilating the front compartment of his automobile a motorist adopted the ship-type ventilator with success, installing two of them on the cowl as illustrated. In the position shown, they allow cool air to enter the driver's compartment, and by reversing them, the air is exhausted, and the heat from the engine passes into the front part. Thus they will serve for both summer and winter driving. The construction is simple. The cone is cut from a piece of sheet brass bent and soldered at the edges. A length of brass tubing is soldered to the hole in the cone and a flange is soldered to it, so that the ventilator can be mounted in position on the cowl, as shown, a hole being cut through the latter for this purpose. On the part of the tube below the cowl, a coil spring is held by means of a washer and pin, and the lower end of the tube is fitted with a screen to keep out insects that may be caught by the draft.

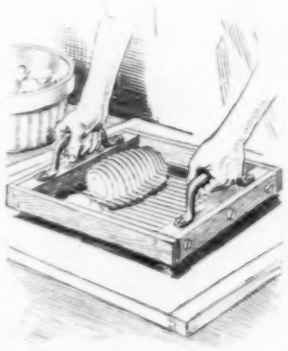


Easy Way to Clean a Clock

When a clock stops it is a mistake to suppose that it must be taken to the workshop for repairs. In most cases clocks stop running simply because of an accumulation of dust particles, which clog the bearings. It is not even necessary to take the clock apart to clean it. A simple method, which has been found to work well, is the following: Soak a piece of cotton wool in kerosene and place this in a small saucer, a lid, or any similar small receptacle. Then put this in the case of the clock under the works. Close up the clock, and at the end of 24 hours, the cotton wool will be found to be covered with small black specks; these are the dust particles brought down by the fumes of the kerosene. Wind the clock and it will usually start again. Where the works of the clock are in an inclosed case, a few drops of kerosene should be poured through a small hole in the metal covering and the clock turned about a while so that the kerosene is well distributed. A small quantity is sufficient; too much will do more harm than good. After a short time the clock will usually run again.—Edwin Tarrisse, Washington, D. C.

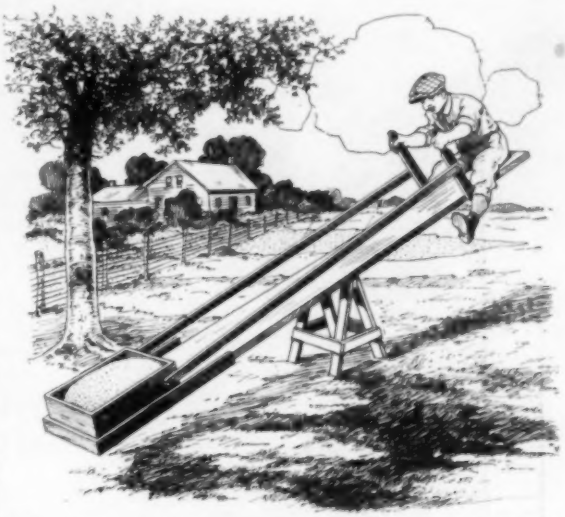
Vegetable Slicer

Slicing cooked vegetables can be done easily and quickly by means of the simple device shown in the drawing, which can be made by anyone. It consists of a wooden frame, about 6 in. square, made of ½ by 1¼-in. material, preferably hardwood, and a number of lengths of fine piano wire. These are bent at each end at right angles, for about ¾ in., and strips of wood or strap iron are screwed tightly to the frame over the ends. Ordinary drawer pulls can be fastened to the frame to serve as handles. The method of using the slicer is self-evident.—James E. Noble, Toronto, Can.



Novel "One-Boy" Seesaw

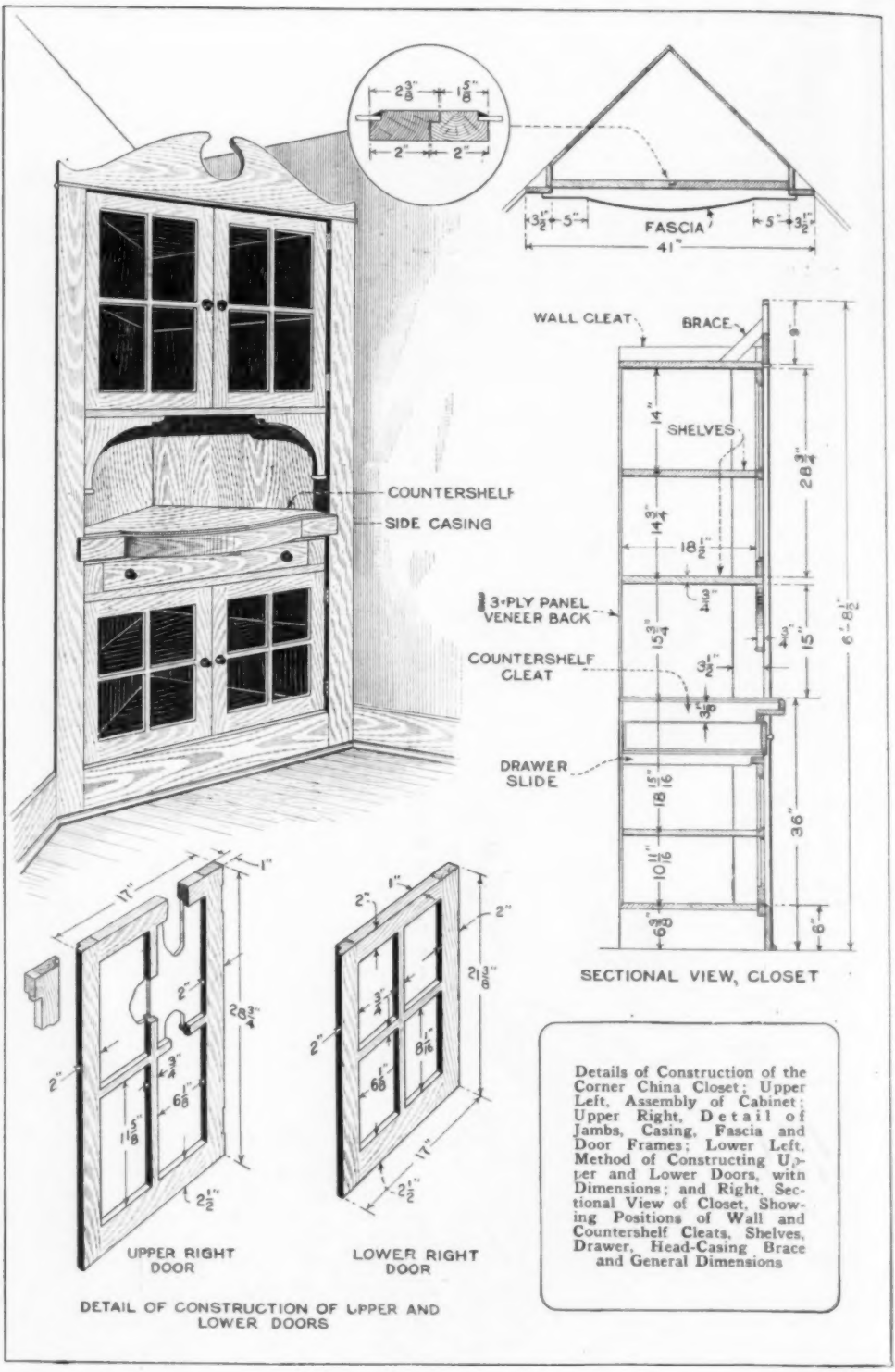
Most playground seesaws require two persons to operate them. Finding this feature objectionable, a schoolboy with an inventive turn of mind devised a seesaw equipped with a movable counterweight, which enabled him to operate it alone. The counterweight consists of a wooden box placed near one end, and two lengths of 1 by 2-in. wood, attached to the box and to a pair of handles, which are pivoted on the seesaw within easy reach of the operator. The distance from the box to the center of the seesaw should be about the same as that from the center to the seat on the other end. A quantity of sand, approximately equal in weight to that of the one using the seesaw is put in the box, and then by moving the box back and forth the balance can be readily changed, causing the seesaw to work just as if two persons were operating it. The counterweight end of the seesaw is boarded in as shown to confine the movement of the sand box.



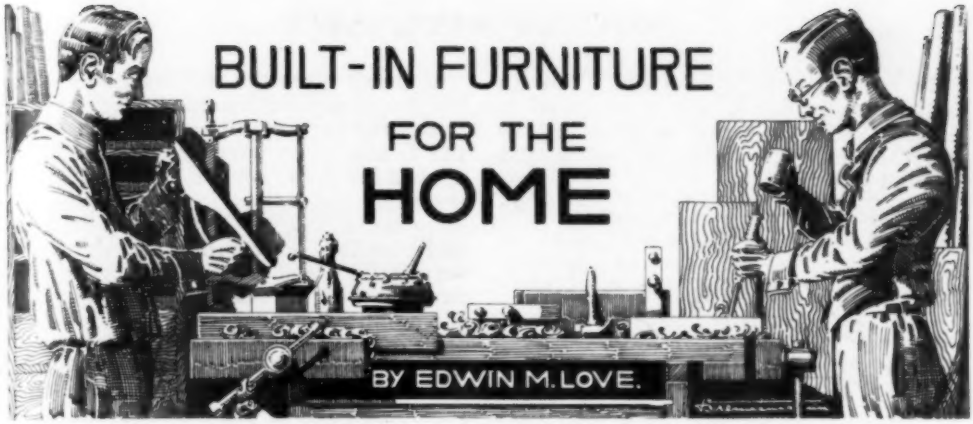
Novel "One-Boy" Seesaw Operated with Aid of Sand-Filled Counterweight

Dangers to Gems

As pearls consist of carbonate of lime, vinegar and other acids will eat away the polished surface in a short time. Hot water is fatal to an opal, destroying its fire and sometimes causing it to crack. Soap is a deadly enemy of the turquoise. If a turquoise ring is kept on the hand while washing, in a short time the blue stones will turn to a dingy green.—Mrs. Theo. Bush, Bay City, Mich.



Details of Construction of the Corner China Closet; Upper Left, Assembly of Cabinet; Upper Right, Detail of Jambs, Casing, Fascia and Door Frames; Lower Left, Method of Constructing Upper and Lower Doors, with Dimensions; and Right, Sectional View of Closet, Showing Positions of Wall and Countershelf Cleats, Shelves, Drawer, Head-Casing Brace and General Dimensions



Part IV—Corner China Closets

OF dining-room cabinets, the corner china closet is probably the easiest added to a house already built. Certainly to utilize a spare corner, or, better, two, for china cases of the design illustrated, is to add to the beauty and convenience of a dining room, even though it may contain a buffet of the usual kind.

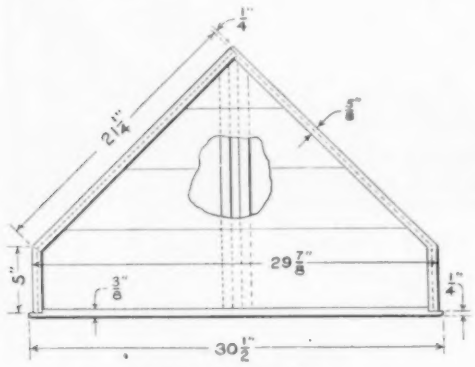
This closet is 2 ft. 10 in. wide between the side jambs, and 6 ft. 8½ in. high to the underside of the head jamb (the usual height of an inside door). If the doors of the room are higher or lower, the height of the cabinet should be altered to correspond. The top of the countershelf, in any case, is 3 ft. above the floor. The drawings show side castings 3½ in. wide, but if possible, they should be of the style and width used in the rest of the room trim.

Glue up the shelves, cutting them roughly to shape from 1 by 12-in. pine, and reinforcing the joints with corrugated fastenings driven into the top or bottom, according to the position of the shelf above or below the line of vision. The dimensions for the head jamb, or top of the china closet, are the same as for the countershelf (shown in the detail), as is the case with the shelf above the countershelf, except that the front edge is straight, while the other shelves are 1 in. narrower from front to back corner, as the doors close against them.

The side jambs are of 1 by 4-in. stock, sized to 3½ in. in width, and cut 1 in. longer than the height of the cabinet. Lay them out for the spacing of the shelves, bearing in mind that the middle shelves of both sections line with the crossbars of the sash doors. Dado them ⅜ in. deep and assemble the shelves with the jambs. Lay the assembly, face down, on blocks on the floor, or some other support capable of holding it solidly without twist, and brace the shelves so that they are perpendicular to the front edges of the jambs and square with them. Fit one of the pieces of panel veneer, 26 in. by 7 ft., against the back edge of a jamb and rip it to width. Nail it solidly to the shelves with fourpenny and sixpenny finish

An Attractive and Useful Addition to the Dining Room That Takes Up Little Space and Is Easy to Build

nails, spacing them 2 in. apart. Remove the braces and fit the other back panel in place, allowing the rear edge to extend past the first piece, and nail the second through into the first.



DETAIL OF DRAWER

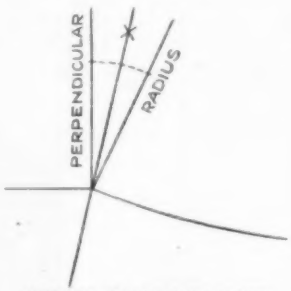
Cut two drawer rails of 1 by 2-in. net pine, 2 ft. 10 in. long, and tack into place beneath the countershelf, as indicated in the elevation and the countershelf detail. The bottom of the upper rail is exactly 3½ in. below the top of the countershelf, and the top of the lower rail, 7⅝ in. below. Bore through the jambs into the ends of the rails for two ⅜-in. dowels, and nail fast to hold the rails until the glue is dry. Nail and glue 1 by 2-in. stiles between the rails, making the width of the drawer space 2 ft. 6 in. Put in the lower frame rail with dowels, 2 ft. 6 in. below the top of the countershelf.

To stiffen the countershelf, glue and nail 1 by 2-in. cleats to the backs under it, and fit the center cleat, 1 by 3⅛ in. net, gluing it to the shelf and toenailing the front edge into the upper drawer rail.

The curved fascia is built up of two thicknesses of ⅜ by 2-in. net pine, glued together and clamped to a form while wet. The detail gives the method of setting a bevel square for the angle of the joint between the curved and straight sections of the fascia. The backing segment is cut from 2-in. stock, or two sections of 1-in. material, and nailed in place under the countershelf, against the upper rail. Nail and glue the fascia into place, showing a margin on the shelf of a scant ⅛ in., and fit the straight pieces afterward, when the casings are in place.

Two brackets, laid out as shown, are nailed in place underneath the shelf above the countershelf, and are set back from the front edge of shelf and jambs ¼ in. A short length of ⅜ by 1⅛-in. neckmold, rounded on the end, is tacked underneath, forming a bead. Drive the nails from the back through the jambs and into the shelf from the under edges of the brackets.

The cabinet is now ready to set. Cut the baseboard with the point of a saw and a chisel 2 ft. 2 in. from the corner of the room, and remove the pieces. Stand the cabinet in the corner, and by means of wedges, thrust between the sides and the plaster, plumb it both ways, afterward making it solid by means of 1 by 2-in. cleats above the head jamb and nailed to the wall. So placed, the faces of the jambs should be but ¼ in. farther from the plaster, measured in the plane of the front, than the width of the casing to be used. If the distance is greater, do not hesitate to remove enough plaster from behind the cabinet to allow it to go back

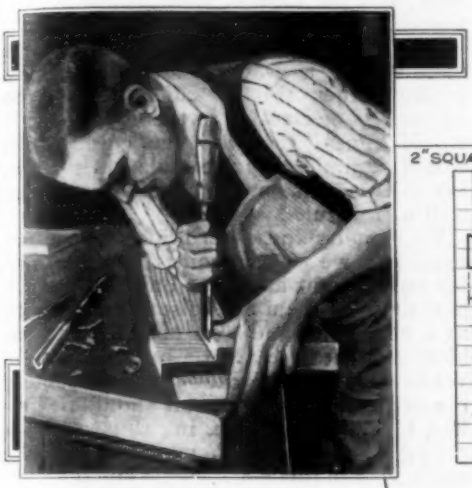


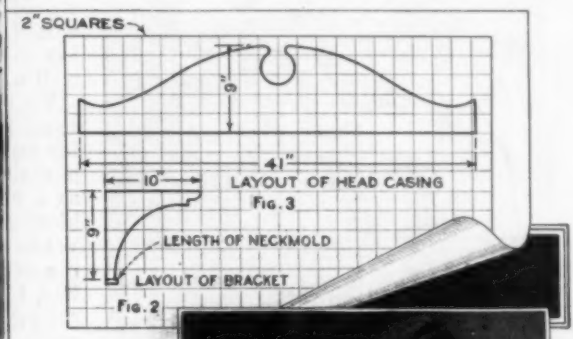
METHOD OF SETTING BEVEL SQUARE FOR FASCIA JOINTS

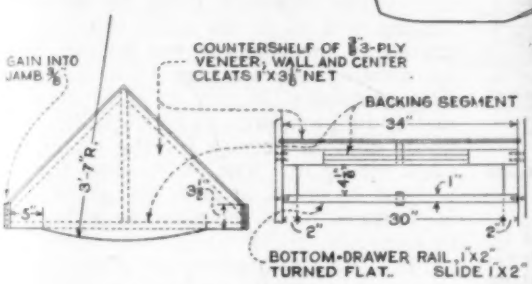
MATERIAL LIST

2 pieces, 26 in. by 7 ft., panel veneer, three-ply fir.
1 piece, 30 by 30 in., panel veneer, three-ply fir.
1 piece, 1 by 4 in. by 14 ft., pine or fir, S4S, sanded.
1 piece, 1 by 4 in. by 4 ft., pine or fir, S4S, sanded.
1 piece, 1 by 10 in. by 4 ft., pine or fir, S4S, sanded.
2 pieces, 1 by 12 in. by 12 ft., pine or fir, S4S, sanded.
1 piece, 1 by 2 in. by 12 ft., pine or fir, S4S, sanded.
2 pieces, 1⅛ by 2 in. net by 12 ft., pine or fir, S4S, sanded.
1 piece, 1⅛ by 2½ in. net by 12 ft., pine or fir, S4S, sanded.
1 piece, ⅛ by 2 in. net by 6 ft., pine or fir, S4S, sanded.
4 ft. 1-in. cove.
3 ft. ⅜ by ¾ in. base shoe.
1 piece, ⅝ by 6 in. by 3 ft., round-edge baseboard.
1 piece, ⅝ by 5 in. by 5 ft., drawer sides.
1 piece, 1 by 5 in. by 3 ft., pine drawer front.
1 ⅜ by 1⅛ in. by 4 ft., round-edge neckmold.
1 piece ⅜ by ¾ in. net by 14 ft., pine, sanded (for muntins).
2 sheets of D. S. glass, 13⅝ by 24⅞ in.
2 sheets of D. S. glass, 13⅝ by 17½ in.
4 pair 2½ by 2½-in. loose-pin butts, to match door hinges.
6 1⅛-in. glass drawer pulls (knobs).
2 frog catches.
2 elbow catches.
1 lb. six-penny finish nails.
¼ lb. four-penny finish nails.
1 doz. ⅝-in. corrugated fasteners.
Cost of materials, about $15.
Time to build, about 20 hours.

properly. Before casing, nail blocks into the triangular space between the jambs and walls for backing. Should the plaster be irregular trim the back edge of the casing to permit the front to be nailed back straight and true. Show a margin on the jamb of ¼ in.







DETAIL OF COUNTERSHELF
Fig. 4

Fit the neckmold against the upper jamb, insuring a tight joint on the underside by beveling the back edge. Make a projection beyond each casing of ⅜ in., rounded off to the profile of the front. The head casing, shaped according to the layout in the illustration, is nailed against the head jamb and a cleat set between the wall cleats, and is well braced by strips of 1 by 2-in. pine nailed behind and bearing against the top.

Fit the straight ends of the fascia against the curved fascia, allowing a projection of the ends beyond the casing edge equal to its projection in front. Reduce the thickness of the cove to ½ in. and fit it around under the fascia.

Build the doors according to dimensions given in the drawing. Bore the dowel holes before rabbeting for the glass. Cut the rabbet ⅜ in. deep, leaving ⅜ in. of stock for the glass to bear against. The muntins, of ⅜ by ¾-in. net pine, half-lapped at the joints, are secured to the stiles and rails by means of brads. The double-strength glass is put in each sash in single sheets, and retained by small moldings or strips of wood.

In hanging the doors, line the upper ends of the top hinges and the lower ends of the lower hinges with the inner edges of the rails, allowing them to project about ½ in. Build the drawer as shown in the detail, inclosing the bottom of ⅜-in. panel veneer with the sides, since it could not be slipped in afterward. The ends and top of the front have a ¼-in. flange projecting ⅜ in. beyond the body, smoothly rounded for neatness. By taking care in placing the guide between the lower drawer rail and the back corner, and the two ¼-in. guide strips on the bottom of the drawer, it will slide easily.

Fit the baseboard and shoe mold to the front of the lower rail, sand the cabinet thoroughly, and it is ready for the finish.

Novel Sliding Gate

On farms where high fences are used, a sliding gate of the kind shown in the drawing will prove to be convenient. It can be made from materials available almost

Useful Sliding Gate Suspended by Flat-Iron Hangers on Rail Made of Pipe

everywhere. The rail is a length of ½ or ¾-in. pipe, supported at each end by an elbow, a short nipple and a flange, the latter being securely screwed to the post. The gate hangers are made of flat iron, screwed to the gate and bent over to slide easily on the rail. Grease is applied to the rail every two or three months, to reduce the friction and permit the gate to slide noiselessly. For large gates, it is advisable to provide a stop on the outside, near the bottom, to prevent them from swinging outward in a strong wind.—Dale R. Van Horn, Walton, Nebr.

How to Design a Water Rheostat

It is seldom that the average experimenter gives more than a passing thought to the proper design of a water rheostat. The usual method is to use large plates in a container and add a sufficient quantity of salt or acid until the proper current flows. The results are often unsatisfactory, as the solution heats quickly, and may even boil; this gives a resistance that changes in value with the change of temperature and is not conducive to good results in experimenting. The problem of designing a water rheostat resolves itself into a question of the size and kind of plates, the density of the solution to be used, and the kind of chemical to be employed.

The maximum current that can be handled by a water rheostat depends, among other things, chiefly upon the amount of electrolyte in the container. It would appear that the energy absorbed would be limited by the radiation surface, but calculations on this basis do not check well with results.

To simplify the description we will assume that we wish to construct a rheostat for an arc light and have on hand a large porcelain jar from an Edison-type battery as a container, and iron plates. The cubical contents are a little over 422 cu. in. When used indoors without special cooling the capacity of the rheostat should be limited to 2 watts per cu. in., thus giving a rating of 2 times 422, which equals 844 watts for the rheostat. Some voltage drop across the rheostat must be assumed. Taking this to be 80 volts, the amperes passed by the rheostat can be calculated by dividing the wattage by the voltage drop, resulting, in this case, in approximately 10½ amperes. The allowable maximum current density for the plates is 1 amp. per sq. in. The plates must then be at least 10 sq. in. in area, but, since there is plenty of room, we may use plates 5 in. in diameter, giving an area of about 19.5 sq. in. This reduces the current density per sq. in. of plate, and consequently reduces polarization and plate resistance. The upper plate is perforated with holes made with a 20-penny nail, and is fastened to an adjusting rod by two bolts, one on either side of the plate. The lower plate is left plain, and a rubber-covered wire connected to it.

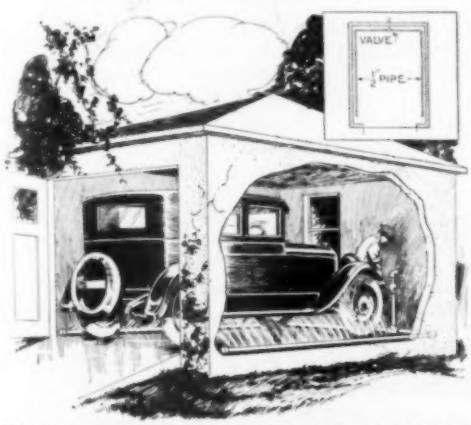
Having determined the mechanical design of the rheostat, the kind of solution to be used, and its density, must be determined. The chemical is a matter of judgment. We may make use of sodium sulphate, sodium chloride, or copper sulphate with iron plates. Where carbon or lead plates are used we may employ sulphuric acid. A simple rule for calculating the density of the solution in percentage is as follows: Multiply the maximum distance between plates by any one of the following constants: Sulphuric acid .08; sodium chloride .25; sodium sulphate .45; and copper sulphate .90; divide the result by the maximum voltage drop. Since copper sulphate does not polarize the plates

it is selected for the rheostat. This solution was made up and found to give the desired results.

By following the above method a rheostat for any other purpose may be constructed with full assurance that the device will do the work in a satisfactory manner. It is only necessary to bear in mind the relationship of the various factors, which may be listed as follows: The energy absorbed depends upon the volume of the electrolyte; the area of the plates is determined by the current, which should not exceed 1 amp. per sq. in. The voltage drop is determined by the maximum distance between the plates; where this is limited by the size of the container the density of the solution is varied to obtain the proper results.—Thos. W. Benson, Philadelphia, Pa.

Washing the Car Chassis

More mud and dirt collects under the body on the chassis than anywhere else on the car. A simple and efficient method of removing this is to use a stationary sprinkler of the kind shown in the drawing, provided water under pressure is available. It can be installed in any garage having a concrete floor and good drainage, and consists of two lengths of ½-in. water pipe, perforated with a number of small holes. The pipes are arranged along the sides of the garage and connected to the water supply. The distance between

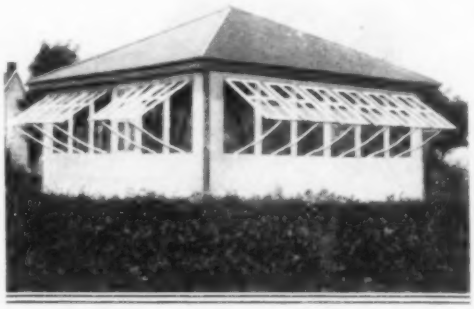


Water Sprayed against Underside of Car Chassis Removes Mud and Dirt

the pipes should be a little greater than the tread of the car so that the spray will strike the underside of the chassis. Thus the water will reach parts that are nearly inaccessible when using a hose.—G. A. Luers, Washington, D. C.

A Well-Ventilated Summer Kitchen

In the ordinary farm house the kitchen is the most used room and during the summer months it sometimes becomes unbearably hot as all the cooking is done



Open-Air Summer Kitchen on the Farm Has Good Appearance and Maximum Ventilation

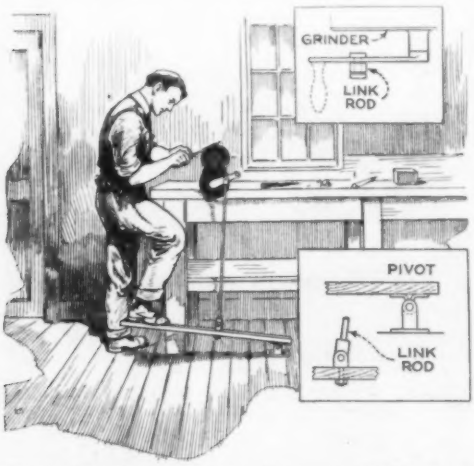
there. To provide relief, a summer kitchen and dining room of the kind shown, which is separated from the house, has been found very convenient for cooking and can also be used as a laundry. It is about 16 ft. square and has as many windows in the sides as possible in order to provide maximum ventilation and light. The windows are hinged at the top and open outward from the bottom, two-piece folding braces being used to hold them open; the braces are hinged at the center on the underside and the ends at the hinges are cut at a slight angle, so that the weight of the windows causes them to bow slightly downward as shown. Screens are, of course, provided on the inside to make the interior fly-proof. The outside may be painted white to preserve the wood and improve the appearance.

Thawing Frozen Radiators

When putting his car in the garage for the night, a motorist found his radiator frozen near the bottom and around the petcock. Not wishing to thaw it with hot water, or to steam it out in the morning, he bent the overflow tube so that it was directed against the cock and started the motor, until steam developed. The steam was thus ejected on the petcock, and in a short time the frozen part was thawed out so that the water could be drawn off. Care should be taken not to bend the tube so as to choke it or interfere with the operation of the fan.—Richard C. Tarr, Gloucester, Mass.

Treadle for Hand Grinder

Small bench grinders are often rather inconvenient to use because the worker cannot hold the work with both hands,



Simple Treadle Attachment Increases Usefulness of Hand Grinder

which is often necessary and always best. The drawing shows a simple attachment that permits one to run the grinder with the foot. It consists of a treadle pivoted at one end to the floor, as shown in the detail, and an iron connecting rod attached to the treadle and to the grinder crank. This attachment is easily made by anyone and well worth the making.—G. A. Luers, Washington, D. C.

Testing Painted Woodwork

To test the purity of paint on woodwork shave off a splinter with a knife and burn it with a match or hold it over a gas flame until it burns brightly. Then remove and hold it over some dark cloth or paper. If pure lead paint was used, little silverlike beads, which are metallic lead, will drop off the charred splinter. To test any paint to be used, dip a sliver into the paint, and after it is dry, test it the same way.—S. A. Pease, Wauwatosa, Wis.

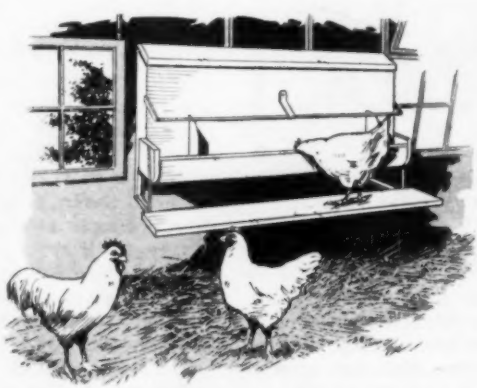
Fishing with an Umbrella

A handy net for catching killifish, which can be neatly folded and readily carried in a fishing-rod bag, may be made by recovering an old discarded umbrella frame with mosquito netting. Although primarily intended for catching "killies" by placing a few cracked clams or mussels in its center and lowering in shallow water not over 2 ft. deep, it can also be used for catching the beautiful silver-banded spearing by baiting it with a few pieces of shrimp. Tie the pieces to the frame near the center and suspend the net in deeper water near a sod bank. When codfish and flounders are running, the net, baited with shrimp, can be used from the end of a dock. One must be patient, allowing the net to remain down for some time before drawing it up, but when the fish are present at all, the number taken at one haul will more than make up for the time spent in waiting.

An old umbrella is also very convenient to have along when "bobbing" for eels at night. String a dozen or more worms on strong thread, winding them up into a ball and wrapping the thread well around the mass. Let the ball sink to the bottom and when a bite is felt draw in the line and shake the eel off into the umbrella, which has previously been hung over the side of the dock.—John D. Mayer, New York.

Substantial Poultry Hopper

Unlike most grit and feed hoppers for the poultry house, the one shown in the illustration is set high above the floor, permitting the fowl to walk under it. To enable them to reach the contents easily, a broad platform, about 8 in. wide and supported by flat-iron braces, is attached to it, about 4 in. above the floor. The hopper is made of galvanized iron. It is divided into four compartments and the top is hinged. An iron rod runs from end to end, above the trough, to prevent restless birds from roosting on the edge. This rod should be placed so close to the side that the birds lose their balance if they try to perch on it.

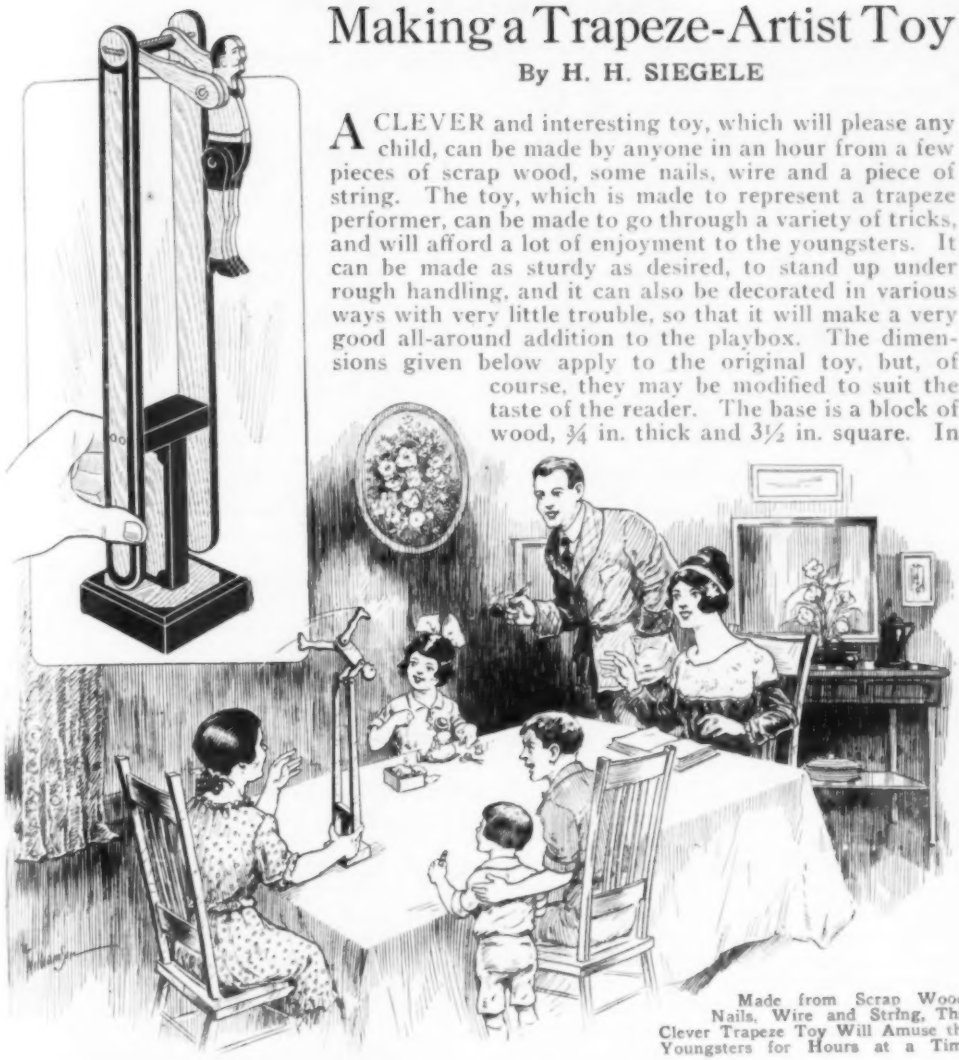


Galvanized-Iron Poultry Hopper Is Sanitary and Cannot Be Used as a Roosting Place

Making a Trapeze-Artist Toy

By H. H. SIEGELE

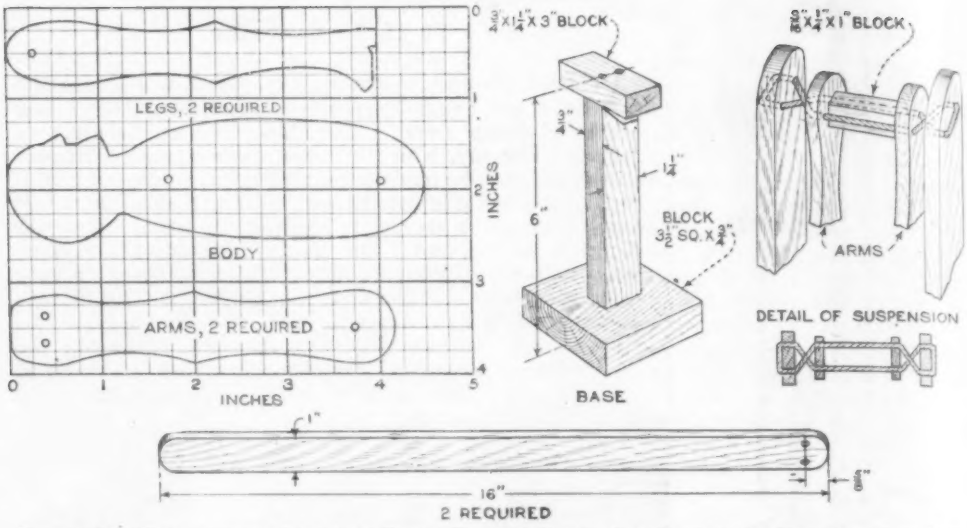
A CLEVER and interesting toy, which will please any child, can be made by anyone in an hour from a few pieces of scrap wood, some nails, wire and a piece of string. The toy, which is made to represent a trapeze performer, can be made to go through a variety of tricks, and will afford a lot of enjoyment to the youngsters. It can be made as sturdy as desired, to stand up under rough handling, and it can also be decorated in various ways with very little trouble, so that it will make a very good all-around addition to the playbox. The dimensions given below apply to the original toy, but, of course, they may be modified to suit the taste of the reader. The base is a block of wood, ¾ in. thick and 3½ in. square. In



Made from Scrap Wood, Nails, Wire and String, This Clever Trapeze Toy Will Amuse the Youngsters for Hours at a Time

the center of this is nailed an upright or column, ¾ in. thick by 1¼ in. wide and 4½ in. long. Across the top of this is nailed a crosspiece, ¾ in. thick, 1¼ in. wide and 3 in. long. The body is cut from wood ⅛ in. thick. It is best to obtain a piece of material large enough to make the body, arms and legs, and to mark this out in 1-in. squares so that the pieces can be laid out on it in the same manner as shown in the detail drawing. A piece 4 by 5 in. in size will do. If wood as large as this cannot be obtained a piece of paper can be marked off in 1-in. squares and the parts laid out on it at one time, when they can be cut out and pasted down to the smaller pieces of wood to serve as guides for cutting. After they are cut, a small hole to take a piece of thin wire is drilled at the bottom of each arm, the top of the legs, and at the points where these units are pivoted to the body. Two larger holes, to take the string to be used, are drilled at the tops of the arms, in line with each other.

The arms and legs are then pivoted to the body by means of the wire, looping the latter at each side so that it cannot come out. A small block of 3/16-in. wood is tacked or glued between the arms at the top, as shown in the detail. Two strips of wood, 16 in. long and 1 in. wide, are next cut. These should preferably be of hardwood, such as hickory, about ⅛ in. thick, but if this is unobtainable, soft wood, ¼ in. thick, (this was used in the original toy) can be used. Two holes are drilled in the top of each, corresponding to the holes in the top of the arms, and the strips then nailed to the crosspiece.



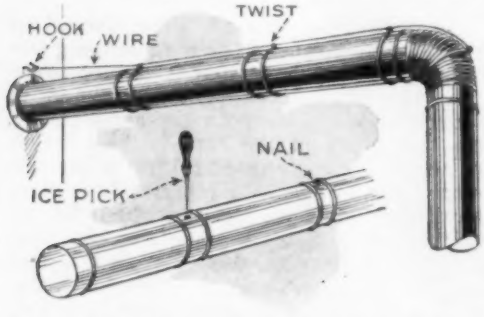
Layout of the Body, Arms and Legs of the Trapeze Toy, with Details of the Supports and Base: Note Especially How the String Is Run through the Holes in the Top

The method of suspending the figure is shown in the detail, and the string must be run through the holes exactly as indicated, else the toy will not perform. Now, by grasping the bottom of the upright strips and squeezing them together, then releasing them, the figure will swing over the "trapeze," turn somersaults, and perform a number of other tricks.

The figure can be painted flesh color, with black or red trunks, or may even be provided with cloth tights, glued on. The remainder of the toy can be painted in any manner desired.

Holding Stovepipes Securely

Horizontal sections of stovepipe have a tendency to sag and may even slip apart. This trouble can be prevented by tying them together with a length of wire as shown in the upper part of the illustration. The joints are first pushed together and a hook is driven into the wall just above the stovepipe. The wire is tied to the hook and looped around each joint, being pulled up tight while progressing. This is continued until the elbow is reached, where the wire is securely twisted and cut off. Another method of preventing the pipes from getting loose is to punch a small hole, at each joint, through the telescoped ends of the pipe sections on the top side, and insert a flat-head nail in each hole, as shown in the lower detail.



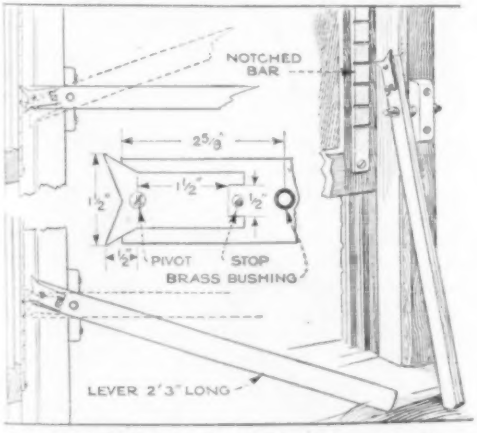
Neat Methods of Holding Horizontal Sections of Stovepipe Together Securely

Method of Distinguishing Extension Bells

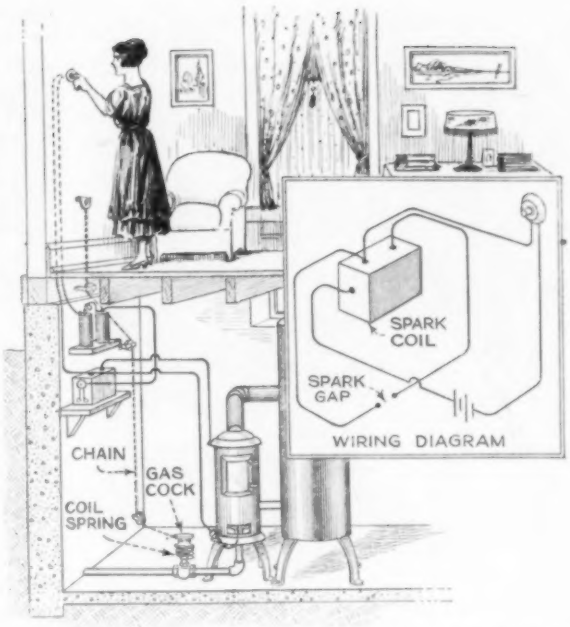
When there are two or more bells in use in the same room, some contrivance is needed to indicate which one has been ringing. Often an annunciator is used, but this imposes some additional load on the telephone line and must also be reset each time a bell rings. A simpler plan, which has been used successfully, is to attach a light coil spring to each bell clapper. The spring is placed in a horizontal position and can easily be fastened by a few drops of solder. When any bell in the room rings, its spring is set in vibration and continues to vibrate for ten or fifteen seconds after the sound ceases. One can then tell at a glance which bell has been ringing.—R. L. Campbell, Bellingham, Wash.

Handy Window Raiser

A bathroom window is often located just behind the tub, which makes it nearly impossible to open it without standing in the tub. This difficulty was eliminated in one case by providing a lifting jack of the kind shown in the illustration. It consists of a wooden lever, about 2 ft. long, pivoted on the side of the window casing, and provided with a movable dog at one end, which engages a notched bar screwed to the sash. The notches or grooves are about 1 in. apart and are cut with a hacksaw. The dog is cut from 3/16-in. steel plate to the shape indicated in the insert. It is pivoted to the lever at the V-notched end, and in the center of the square notch, at the other end, a wood screw is driven into the lever to limit the swing of the dog. A brass bushing is provided at the pivot point of the lever. In opening the window the lever is moved upward, as shown by the dotted lines in the top detail, until the upper tooth of the dog engages with a notch, and then down, which action causes the sash to be raised, the dog being prevented from slipping by the stop pin. A similar stroke is made for each notch. To close the window the action is reversed, and in this case it is the lower tooth of the dog that pushes the sash down. If the sash is not counterweighted, the device will not work.—D. O. Woodbury, Boston, Mass.



Inaccessible Window behind Bathtub Opened by Means of Simple Lifting Jack

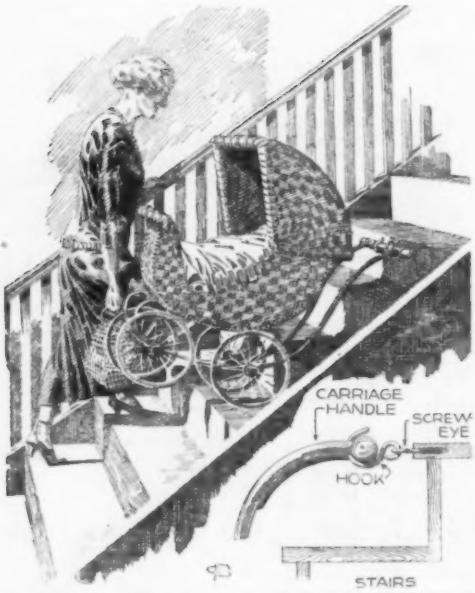


Lighting the Water Heater from a Room Upstairs by Means of a High-Tension Spark

Electric Lighter for Water Heater

Many houses have a gas water heater in the basement for summer use. To light it it is necessary to go downstairs and this is rather unhandy. With the apparatus shown in the illustration, it is possible to turn on the gas and ignite it with an electric spark. The valve in the gas line is provided with a coil spring, which shuts off the gas automatically. It is opened by means of a length of furnace chain, wound on a spool that is attached to the valve as indicated. The chain is run over pulleys, through the wall into the room above, the end being fitted with a ring; a plate on the wall holds the chain up in the same manner as a furnace-damper control. These fixtures can be purchased at any hardware store. Two dry cells are connected in series to a Ford ignition coil, which can be obtained at a garage. One side of the coil is grounded on the stove and the other wire terminates about ¼-in. from the burner, directly above the gas holes so that after the gas has been turned on, a spark jumping this gap will immediately ignite it.—Harold Keckley, Toledo, Ohio.

¶ Quicklime added to benzine, in the proportion of about 3 oz. to the gallon, will deodorize it. Shake well, then strain through cheesecloth.



Baby Carriage Stored Conveniently on Side of Stairway

Storing the Baby Carriage

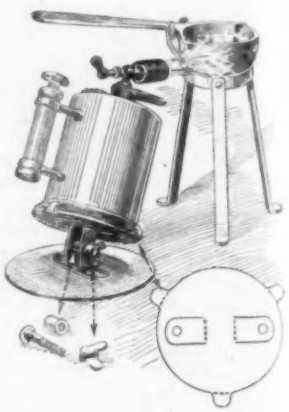
In two-flat buildings the tenant often finds the hall too small to store a baby carriage. The problem of storing it can easily be overcome, however, if the stairway is of normal width. The baby carriage is usually just half as wide as the stairway, and it can easily be held to one of the treads by means of a hook, securely anchored in the tread with a screweye. The illustration clearly shows how this is done. The carriage is stored a few steps above the first floor and this allows plenty of space for people to pass. Of course, where there are three or four flats above the first floor this practice can hardly be used, but where only the owners of the carriage use the stairs there can be no objection raised.—H. Jackson, Chicago, Ill.

A Bacon-Rind Auto Bearing

When a tourist burns out two connecting-rod bearings, 40 miles from a town where repairs can be made, it is quite a temptation to ride on slowly, risking greater damage to the engine. Being in such a predicament recently, and not having any repair parts so that I could do the job at once, the most promising emergency repair which occurred to me was to use a piece of ordinary bacon rind as I well remembered how hard and tough this became when cooked. A strip, about 2 in. wide and 12 in. long, was hammered flat to drive out as much grease as possible, reducing it to a hard, tough piece. This was cut into a number of smaller strips just large enough to replace the babbitt burned from the bearings. They were carefully fitted in place and the connecting-rod caps drawn up tight. After replacing the oil pan and the oil, I started the motor and no knock of any kind was noticeable. I drove to the nearest town, but not finding the condition any worse, decided not to put in a new bearing there. Since that, I drove the car over 5,000 miles with these bacon-rind bearings without experiencing any trouble.—H. G. Borland, Asheville, North Carolina.

Blowtorch Stand

Blowtorches are often used to melt lead and other metals in ladles, but, as no part of the torch is adjustable, it is sometimes rather difficult to play the flame directly under the ladle. To eliminate the necessity of using blocks and shims to accomplish this, a simple adjustable stand, attached to the bottom of the blowtorch, has been found satisfactory. It consists of two disks with brackets in the center, the latter being formed by cutting the metal and bending the cut parts up at right angles, as shown. A bolt, sleeve and wingnut complete the assembly, holes being drilled through the brackets for the bolt. The lower disk must be of greater diameter than the upper one, so that it will hold the torch at any angle it may be set. Small lips left on the edge of the upper disk are bent over to grip the bottom of the torch. The fixture can readily be made by anyone and the details of construction are given in the illustration.—C. Homewood, Ontario, Calif.



¶When the gas line on the truck or car springs a leak, it can be repaired temporarily with a strip of cloth heavily coated with yellow laundry soap, things that are obtainable anywhere.

Driving Nails Straight

An amateur doing odd carpenter jobs around the house will sometimes drive in a nail so that it comes out of the side when about halfway in. The usual practice is to pull it out and try to drive it in straight. Instead of that, I merely take my nail punch and, just as the nail point begins to come out of the side, I put the punch on the point and give it a blow with the hammer, which starts it back into the wood. Then I hit the nail alternately on the head and on the side until it is driven in entirely. In this way I, so to speak, drive the nail around a corner without other damage to the woodwork than the small impression that is made on the side by the punch and this can very easily be remedied by filling the hole with putty.—Geo. H. Mansfield, Cuyahoga Falls, Ohio.

An Easily Made Stencil

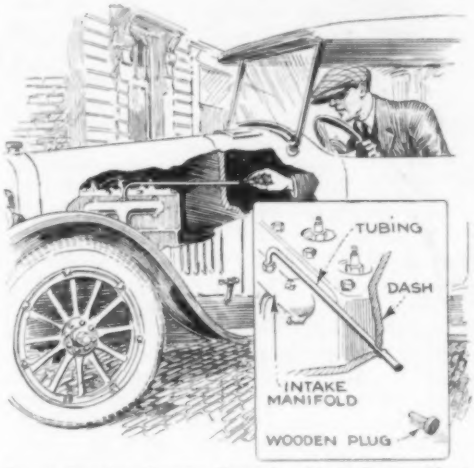
A simple stencil for lettering barrels, boxes and packages can be made from a piece of wire screen. This is cut to the desired size and placed flat upon a smooth surface, and the lettering is painted on it with melted paraffin. The paraffin hardens quickly, cementing itself to the wire. The stencil is used in the ordinary way. The background receives the paint and the lettering is left in the original color of the box or barrel. As the paraffin can be melted from the screen for the substitution of other lettering, it is a good idea to attach a steel-wire frame and handle, as

Easily Made Stencil for Lettering on Boxes and Barrels

shown, to make the stencil durable and easy to manipulate.—G. E. Hendrickson, Argyle, Wis.

Foiling the Auto Thief

A simple and effective method of foiling auto thieves or joyriders is shown in the drawing. Drill and tap a hole in the intake manifold for a ⅜-in. pipe or tube



Secret Opening Permits Excessive Air in Intake Manifold and Prevents Engine from Starting

fitting, and connect a length of pipe or tubing to extend back to the dash. The open end is flared out a trifle to receive a wooden plug made to fit in snugly. When the plug is in place, the engine will run normally but when the plug is removed, so much air is admitted to the cylinder that no combustion can take place and therefore, the car cannot very well be run off on its own power. If, however, the engine is started by excessive use of the choke, the firing will be so erratic that the thief will be glad to abandon the car in a block or so. Of course, the plugged end of the tube should be located in an unnoticeable place behind the instrument board.—Richard P. Cole, Paterson, N. J.

Improvised Scratch Brush

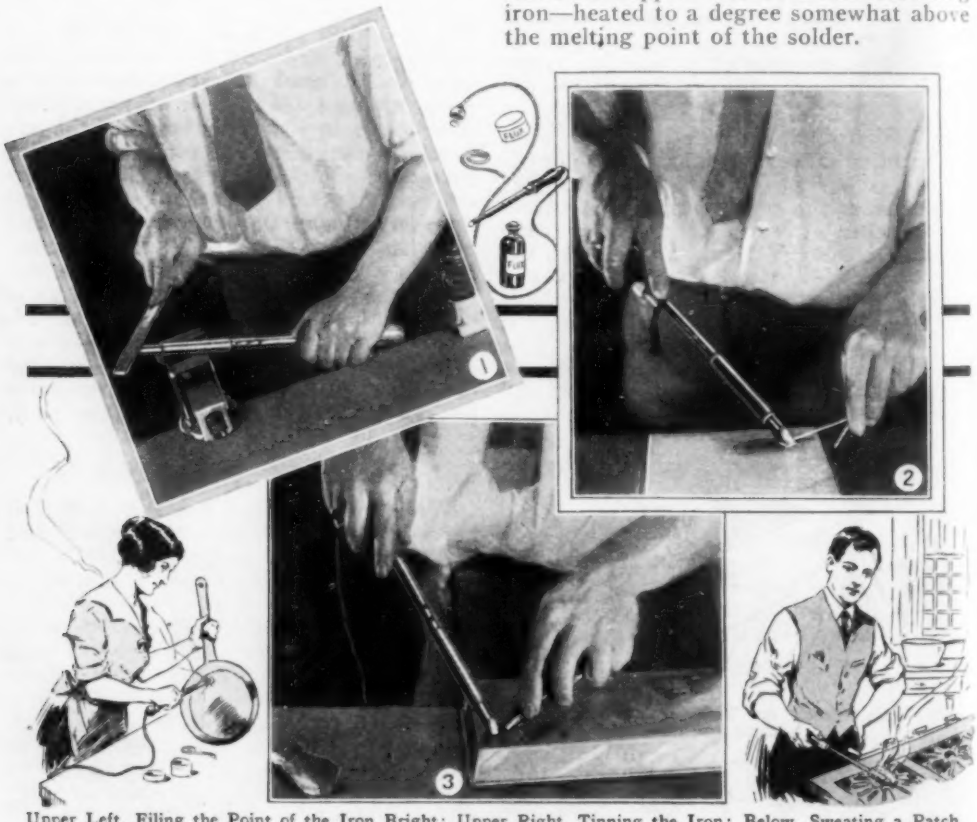
While painting my house I found it necessary to use a wire scratch brush and as I could not buy or borrow one in my neighborhood, I had to make a substitute. A piece of ordinary screen wire was rolled up tightly and a piece of paper wound around it to serve as a handle. The wire end was found to be just as good as any scratch brush. An advantage of such a brush is that it can be made any convenient size. It can be made anywhere, as screen is always available, and it can be fashioned in a few moments.—Otto T. C. Colonius, Kinlogh, Mo.

Soldering for the Home Mechanic

~by~ James Tate

THERE is nothing difficult or mysterious about the art of soldering. On the other hand, the mere possession of a soldering iron, a generous supply of solder, and a large tin of flux does not by any means guarantee a good job. All that is necessary to insure good work, however, is the observance of a few simple rules, together with a little common sense. There is no knack to be acquired, and a few practice jobs, bearing in mind always the rules, will soon make anyone a soldering expert. There are two kinds of soldering, hard and soft, but, as the occasions in which hard soldering (brazing and silver soldering) is required around the home are few and far between, only simple soft soldering will be considered in this article.

Soft solders are composed of tin and lead, alloyed in various proportions, ordinary tinner's solder being half-and-half; that is, composed of equal parts of tin and lead. As the melting point of these solders runs from about 330 to 440° F., they may be easily worked by means of a tool made of copper—the so-called soldering iron—heated to a degree somewhat above the melting point of the solder.



Upper Left, Filing the Point of the Iron Bright; Upper Right, Tinning the Iron; Below, Sweating a Patch over a Hole

Soldering irons are made in various shapes and sizes; also plain, gas, alcohol and electric-heated. Good work may be done around the home with a plain soldering iron, heated on the gas stove or with a gasoline torch, but by far the best tool for all-around home use is the electric soldering iron. This can be plugged into a socket anywhere in the house or garage, thus avoiding the necessity of frequent trips to the kitchen to reheat the iron. The alcohol-heated iron is also a very useful tool, where electricity is not available.

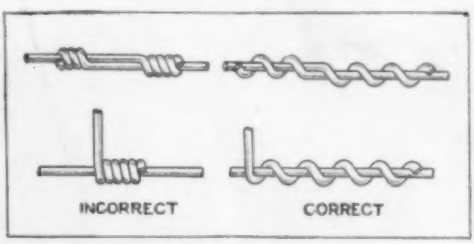
SOLDERING FLUXES	
METAL	FLUX
IRON STEEL	CHLORIDE OF ZINC SAL AMMONIAC
COPPER BRASS	ROSIN SAL AMMONIAC
ZINC (OLD) ZINC (NEW)	CHLORIDE OF ZINC HYDROCHLORIC ACID
TIN	ROSIN CHLORIDE OF ZINC

The prime requirement, in every soldering job, from the simplest to the most complicated, is cleanliness. The parts to be soldered or joined must be chemically clean. To do this, it is first necessary to remove all rust, scale, oxide or dirt from the surfaces to be soldered by means of a file, scraper or emery cloth, using this until the surfaces are perfectly bright. The clean surfaces are protected from oxidizing and the flowing of the solder over them aided by the use of a flux.

For all-around use in the home, the paste fluxes sold in small tin containers are about all that is required, or a supply of acid-core and rosin-core solder. The latter is a hollow ribbon of solder filled with an acid flux or a flux made of melted rosin, dispensing with the necessity for a separate flux.

For the man who likes to tinker around the home shop, the paste flux may be supplemented by a few others, which have been found better for particular uses. These fluxes, and the metals for which they are particularly suited, are listed in the accompanying table. The chloride of zinc, often called "killed spirits," is prepared by dropping zinc (not galvanized-iron) clippings into hydrochloric acid until the acid is "killed," that is, until bubbles cease to arise from the zinc. The acid may then be strained and kept in a glass-stoppered bottle. One caution is necessary in using this flux, and with straight hydrochloric acid also. Don't allow any of it to remain in an open container near tools, or they will become badly corroded. Also, when these fluxes are used, the work should be thoroughly washed afterward, or rust is likely to develop. Finally, never use an acid flux on electrical wiring, as corrosion is sure to follow; use rosin, rosin-core solder, or a paste flux specially prepared for this purpose.

Now for the actual soldering. The first thing to do is to "tin" the iron. Light the stove, if using a plain iron, or plug it into the socket, if an electric one, and, while the iron is heating, hunt up a small piece of tin, brass or copper. The inside of the flux-can lid will do if nothing else is available. Clean a spot on the surface, about 2 in. square, with emery cloth, and drop a little flux on it. If using a plain iron, don't let it get red-hot; it should be just hot enough to melt the solder well. When it has reached this point, remove it from the stove, hold it as shown in photo No. 1, and brighten the point, on all four sides, with a file. If the latter is not at hand, rub the point on a sheet of emery cloth until it is clean, then rub it back and forth on the clean surface of the tin on which the flux was spread, photo No. 2, applying some solder to the point while doing this. Don't forget the flux. The point of the iron will become evenly coated with the solder, and it is then ready for work. When reheating the iron afterward, take care that it doesn't get too hot, or the point will "burn" and must be retinned. When heated to the proper degree—a little experience soon enables the user to determine this—the point may become black or discolored, but the tinning is unharmed, and a dip in the flux quickly removes the discoloration. Most good electric irons need no attention in regard to the heat, and only require a dip in the flux now and then to keep the point bright.



Ordinary soldering is simplicity itself. To solder a leak in the seam of a pail, for example, the dirt must be cleared from around the leak with a scraper of some kind until the surface is as clean as it can be made. Too much emphasis cannot be laid on the cleaning in a job of this kind, as a small spot of grease or dirt will not

Upper Left, Polishing the Work; Upper Right, Applying Flux to Bracket before Tinning; Lower Left, Tinning the Bracket; Lower Right, Sweating the Bracket in Place

allow the solder to flow into the seam, and will cause a lot of trouble. Apply some flux to the surface, heat the tinned iron, and flow the solder into the seam, applying the end of the stick or ribbon of solder to the point of the iron. Don't attempt to stop the leak by dropping some solder from a height of a few inches onto the spot where the leak may be. The metal around the solder must be warm, nearly as hot as the solder, in order to cause it to run. Indeed, it is a good idea to heat the work before applying the solder, if this can be done—but not too hot, or the surface will oxidize, and must be recleaned. The proper way is to keep the iron pressed against the seam, so that it heats the metal, and feed the solder to the point so that it runs into the seam. Soldering a hole in a pail or other utensil is difficult if the hole is so large that the solder will not bridge it alone. In that case it is necessary to patch the hole. Cut a patch of the same metal large enough to cover the hole with plenty of overlap. Clean and polish one side of the patch, and also the spot it is to cover, and coat the cleaned surfaces with flux. Tin both cleaned surfaces with solder by rubbing the hot iron over them, feeding solder to the point; then apply some more flux, lay the patch over the hole and hold it down with some tool as in photo No. 3. Now, by running the hot iron slowly around the edge of the patch as shown in the photo, or holding it on top of the patch, the solder on the tinned portions will melt and unite. This is called "sweating." It sometimes helps to feed a little solder to the iron while running it around the edge of the patch, as the hot solder causes that on the tinned surfaces to melt quicker.

A similar procedure is followed in soldering one piece to another, as in the illustrations showing a small bracket being soldered to a pan. Both surfaces to be joined are polished with emery cloth, photo No. 4, and spread with flux as in No. 5. Each is then tinned, No. 6, and the bracket placed in position and sweated to the pan as shown in photo No. 7.

Small pieces may often be joined by tinning the parts, spreading some flux on them, placing them in the proper position and clamping them with a pair of pliers or tongs, then holding them over the flame of the stove or over a Bunsen burner until the solder melts. They are then quickly removed, and allowed to cool, while still keeping them clamped.

Many amateurs, when making joints in wiring, in their endeavor to make a neat job, coil one wire closely around the other as shown at the left in the detail drawing. This makes a neat connection, from the standpoint of looks, but a poor one electrically, as the close coils do not permit the solder to flow around the joint properly. It is better to make connections like those shown at the right. Here the coils are open, and the solder can make a good electrical connection between them. Remember also, an acid flux must not be used for soldering electrical connections.

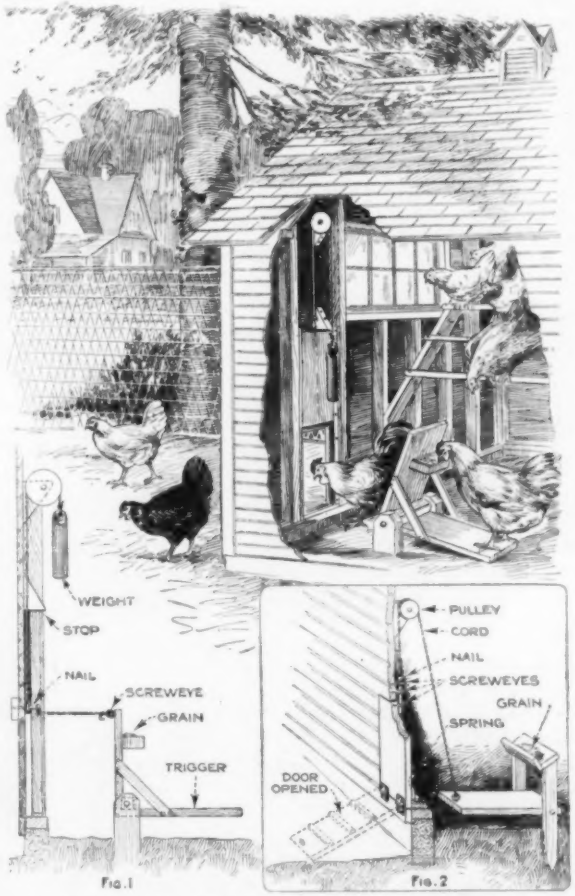
When soldering some parts that are hard to hold together, it is usually a simple matter, once they are tinned, to wire them together while the iron or the gas-stove flame is applied to sweat the joint. A word of caution is necessary when using the flame to sweat joints. Don't apply the flame right at the joint, as it is apt to "burn" the solder, or oxidize the parts. Apply it some distance away, and let the heat run up through the metal to the joint. This also makes the heat easier to control. A few nails driven into the bench or worktable around the parts to be joined will also aid, in many cases, to hold them while applying the solder. It is hardly possible to give specific directions for holding work of this character, as every case is different, but the reader will experience little trouble in devising ways to hold the job.

Letting Chickens Unlock Door

Poultry seems to do best, generally speaking, when they can choose not only the hour for roosting but also the time to sally forth in the morning. With the doors of the chicken house open during the day, they go in when they please, but, if the house is closed overnight, they must wait in the morning until someone lets them out.

It is an easy matter, however, to provide an automatic device that will permit the fowl to open the door themselves. The door is fitted to slide upward, and a screweye is driven into its top, to which is attached a length of stout cord. The latter runs up over a pulley mounted above the door, and a heavy counterweight is attached to the other end of the cord. About a foot away from the door, and directly in front of it, the "trigger" is mounted. This consists of two pieces of wood nailed at right angles to each other, as shown in Fig. 1, and pivoted between two stakes driven into the floor. The trigger is set, with the part nearest the door in a vertical position, and near the top is nailed a small ledge upon which some kernels of corn may be scattered. From the top of this piece a wire runs to a nail pushed through the screweye in the top of the door and into a hole drilled directly behind the screweye in the side of the house.

When the trigger is set, the weight, dragging on the nail, keeps the door shut. The corn is, of course, scattered on the ledge the previous night, just before the farmer goes to bed, and in the morning, when a hungry hen steps on the trigger to reach the corn the additional weight pulls out the nail and the weight opens the door. Fig. 2 shows an adaptation of this device designed for houses where the floor is considerably above the level of the ground outside. In this case the door is hinged at the bottom, and, when dropped, forms a cleated incline to facilitate entrance and exit. A stiff piece of clock spring is fastened to the sill inside and bears against the door, so that, when closed, it will be under pressure. A screweye is driven into the door on the inside at the top, and directly above this two more are screwed into the wall of the house. A nail is dropped through these eyes to lock the door, and the nail is tied to the end of a length of cord running over a pulley and down to the trigger. The latter in this case consists of a single board, and the corn is placed in a small trough joining the tops of the stakes to which the trigger is pivoted.



Two Simple Devices That Enable the Fowl to Open the Door of the Poultry House in the Mornings

Cleaning Developing Trays

For a tray cleaner use a solution consisting of water, 32 oz.; potassium bichromate, 2¾ oz., and sulphuric acid, 3½ oz. Pour it into the tray to be cleaned and swab with a tuft of cotton. The solution may be poured off into a bottle and used several times.

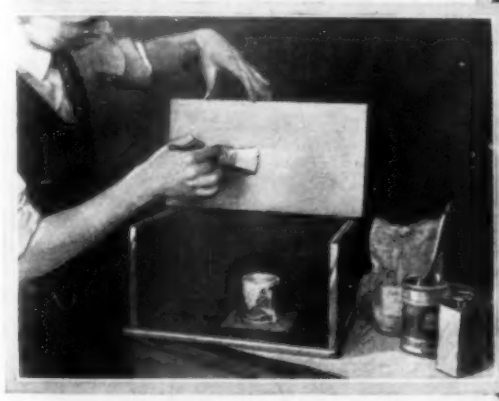
Redecorating the Radio Cabinet

By C. M. OWENS

READY-MADE cabinets are generally finished in dark-brown colors to harmonize with the usual type of living-room furniture. For variety's sake an ornamental design in attractive antique, in Chinese lacquer, or in "tiffany," will be found to give a pleasing effect.

Recently I was given the job of refinishing a cheap-looking mahogany-stained cabinet, which the owner wished to improve. I suggested an antique finish in ivory and proceeded to do the work in the following way: The entire surface was first sanded down with No. 0 sandpaper and then dusted off well. Two thin coats of white shellac were applied to prevent the mahogany stain from "bleeding" (showing through the finish paint). Sometimes two coats of shellac will not prevent this trouble, so it is advisable to apply an extra coat or two, especially over the edges and corners, where bleeding is most apt to occur; each coat must be thoroughly dry before the next is applied. When the last coat of shellac is dry, it is sanded down with No. 0 sandpaper. It should be kept in mind that the smoother the surface, the better the final finish will be; the shellac should fill every crevice and scratch, and all dirt particles that stick to the surface must be removed by sanding. Two coats of flat white paint, colored a little with raw sienna, are then applied. This paint must be thin enough to permit it to be applied evenly, but not so thin that it runs. If, after the first coat of flat white, the mahogany stain bleeds through, apply another coat of shellac to prevent the stain from bleeding through subsequent coats.

After the second coat of flat white has dried, the stencil work is done. Stencils of all kinds can be purchased at large paint stores; usually a catalog containing the various designs will be sent free to any-



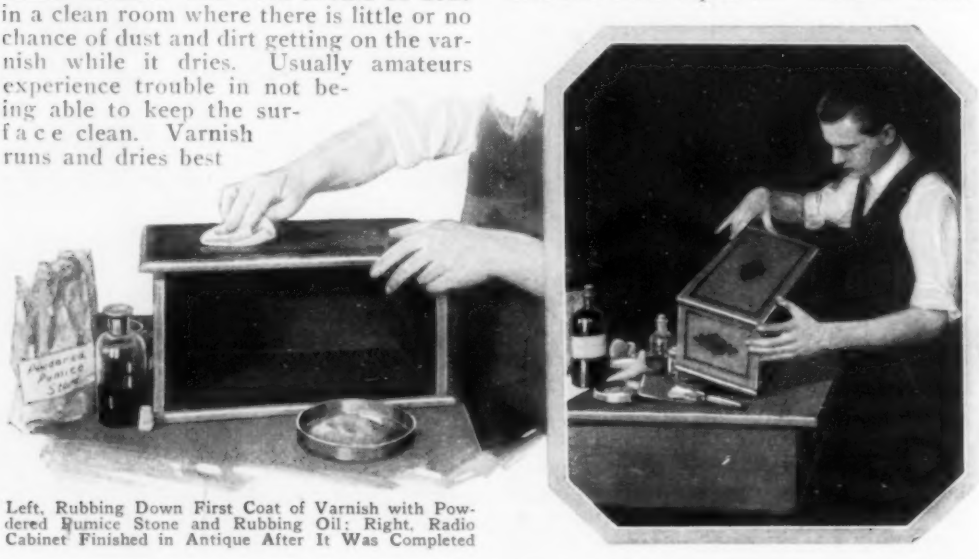
Left, Applying Flat White Paint; Above, Stippling On a Design through a Stencil; Below, Pouncing with a Cloth Ball to Give Mottled Effect

body requesting one. Colors ground in oil are used for stenciling, a few drops of Japan drier being added to assure quick drying. The stenciling job in this case consisted in putting a simple black border on the top and sides of the box and a center design to match. A light pencil mark was drawn along the edge to help in laying the stencil on straight. The stencil is held securely with two fingers while the color is stippled into the perforations with a brush (an old shaving brush will serve the purpose well). The stencil paint must be heavy so that it will not flow under the stencil, causing blotches and runs. Only a little of the paint is used on the brush—just enough to cover the white paint distinctly. Care must be taken to hold the stencil firmly so that it will not slip, smearing the work. If this happens, remove the smear with a clean rag, saturated with turpentine, and then wipe dry.

The mottled or antique effect is produced by pouncing the surface with a cloth ball or dry brush after a darker color has been applied, which in this case may be burnt umber or raw sienna, thinned with turpentine. This is applied evenly all over the surface, and while still wet, the cloth ball is pounced over it to give the desired effect. The color should be left heaviest around the corners and center.

Varnish is next applied, after the surface has dried thoroughly. A good grade of clear varnish should be used—not a damar varnish. The work should be done in a clean room where there is little or no chance of dust and dirt getting on the varnish while it dries. Usually amateurs experience trouble in not being able to keep the surface clean. Varnish runs and dries best when the temperature is about 80 to 85°. A good 2-in. brush is a handy size for applying varnish on a radio cabinet. Care must be taken to give a good even coat; do not attempt to take too much varnish on the brush, smearing it on one place with the idea to brush it out evenly. This can be done with paint, but varnish is very tacky, which makes it hard to spread. Only a little varnish should be taken on the brush and this applied with quick, light strokes. If any hairs come out of the brush onto the surface, they should be picked out at once with a pin or sharp knife blade, or they will disfigure the whole job. After the first coat of varnish is thoroughly dry, rub it down with powdered pumice stone and rubbing oil. This can be done with a piece of felt cut from an old hat. Care must be taken not to rub too hard over the corners and edges or the varnish will be cut. The dust is then cleaned off with a rag saturated with turpentine, and a second coat of varnish applied, proceeding in the same way as before. After this is dry, the surface is cleaned off and polished with good furniture polish.

If the cabinet is entirely unfinished at the start, paste wood filler is applied to fill up the pits. This is always necessary in case of mahogany, walnut and oak. The filler can be obtained in different colors. Of course, a light color should be used if the finished color of the cabinet is to be light, and a dark filler if the finish is dark. The filler is thinned with turpentine to form a paste and is brushed on thickly, left on the surface for a few minutes and then wiped off. After 24 hours the first coat of shellac is applied. The stain must always be used before applying the filler.



Left, Rubbing Down First Coat of Varnish with Powdered Pumice Stone and Rubbing Oil; Right, Radio Cabinet Finished in Antique After It Was Completed

Correct Grid Leak Is Important

One of the smallest parts that enters into the construction of a radio receiver is the grid leak, and in connection with it the grid condenser. As usual with small details they are given little attention. It will surprise many to know that the volume and clarity of reception depend on the correct value of the grid leak and the grid condenser. The grid current is determined by the number of negative electrons that are attracted to the grid from the filament. The negative charge on the grid sometimes piles up to a point where it practically stops the flow of plate current; the grid leak relieves this situation and frees the imprisoned electrons, preventing the tube from choking. This requires a grid leak of correct value for the tube used.

The grid leaks now on the market vary in efficiency; some are correct in value according to their rating, others nearly so, and many are found to be inefficient. When selecting the materials for building your set, always demand the best; this applies especially to grid leaks and grid condensers. Substituting different grid leaks of various resistances in your receiver will often be the means of improving volume and clarity of reception. Each type of tube requires a different type of grid leak and grid condenser. The values of these parts are usually supplied by the manufacturer of the tube, and will be found in the literature accompanying the tube when purchased. A good variable grid leak is recommended by some authorities; another plan is to have several fixed grid leaks varying in value from one to five megohms and you will be able to select the best one on trial.

The variable grid leak is a valuable instrument—if the average user would be content to let it alone once it is adjusted to the best value for the particular tube he is using. Once the leak is properly adjusted it should not be touched unless the tube is changed.

Horn Is Replaced by Cones in Loud Speaker

Of unusual design, pleasing to the eye as well as the ear, a new type of cone-shaped loud speaker has, as its outstanding features, intensity of volume with little directional effect. Instead of a horn, the instrument has a projector within which the actuating mechanism is contained.

The projector consists of two hollow cones with their bases cemented together. The apex of one is cut away to permit attaching it to a bracket, which serves not only as a stand for the projector, but also as a mounting for the sound-reproducing

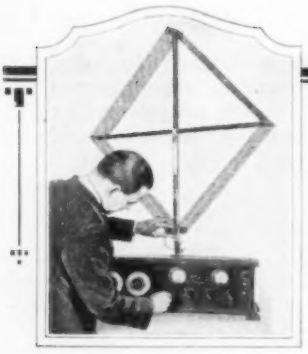
A New Loud Speaker That Enables the Audience to Hear Equally Well from Any Direction

mechanism, which is of the balanced armature type. The armature of the magnet unit is connected with the apex of the outer cone, causing the projector to vibrate with the current impulses.

Connecting Phones to Amplifier

There is a right and a wrong way to connect phones to an amplifier. If they are incorrectly connected they become demagnetized and soon lose their sensitivity.

The simplest way to find which is the best connection, is to plug the phones in at the last step of amplification and tune the receiver to the loudest possible signal; then remove the phone caps and lift one edge of the diaphragm with the finger until it clears the edge of the shell. When the phones are connected in one direction, you will observe a stronger pull than when the connections are reversed. When the connections are so placed as to obtain the greatest pull on the diaphragm, put a mark on the phone terminal that was connected to the plate of the tube. Thereafter always connect the marked terminal to the plate.

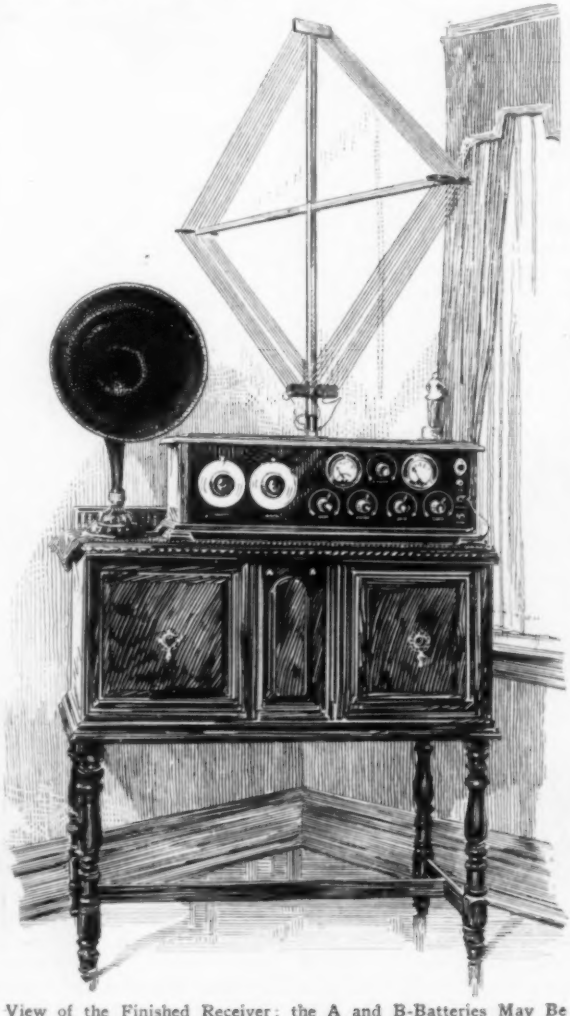


How to Build the Popular Mechanics' Superheterodyne Eight

By F. L. Brittin

Part II

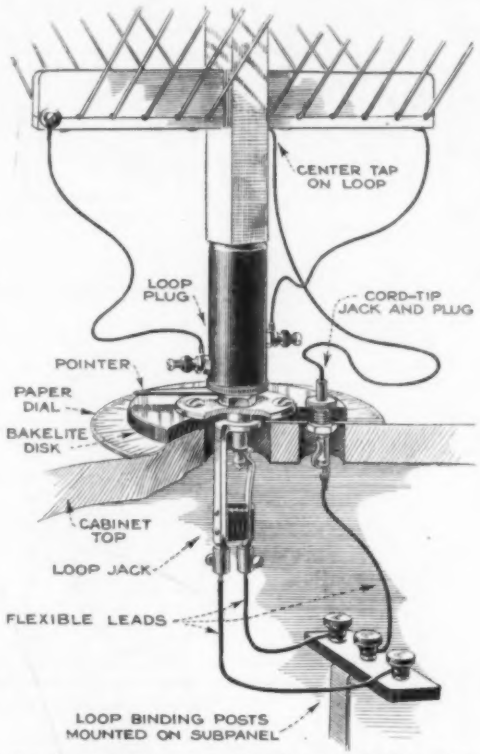
THE subpanel can be either formica or bakelite, ⅛ by 9 by 25 in. in dimensions; refer to the subpanel layout and note the cut-out, ¼ in. deep and 14 in. long; this is to clear the lower part of the rheostats mounted on the front panel. A small cut-out will also be necessary at the left front end of the subpanel, to clear the back of the push-pull switch; the size of this can readily be determined upon assembly. Assemble the various instruments on the subpanel and use a scriber to locate the mounting holes. All holes in the subpanel can be drilled with a No. 27 drill. Be careful to locate the various instruments on the subpanel exactly as shown in the layout. Note that two three-gang sockets are used. The first socket unit at the left is for the second detector and the two audio-frequency amplifying tubes; the two audio-frequency amplifying transformers are placed directly back of their respective tubes. These transformers have a ratio of 3 to 1 and are so placed that the grid and plate terminals are as close as possible to the respective grid and plate terminals of the tube sockets, which allows short and direct leads. This precaution should be taken with all the transformers in regard to the plate and grid leads. The tuned-stage transformer is placed next to the first audio-frequency transformer. On this transformer will be found three little mounting brackets placed under the terminals; the .00025-mfd. fixed condenser is connected across the grid and filament posts on two of these brackets;



View of the Finished Receiver; the A and B-Batteries May Be Housed in a Cabinet, Making a Very Attractive Installation

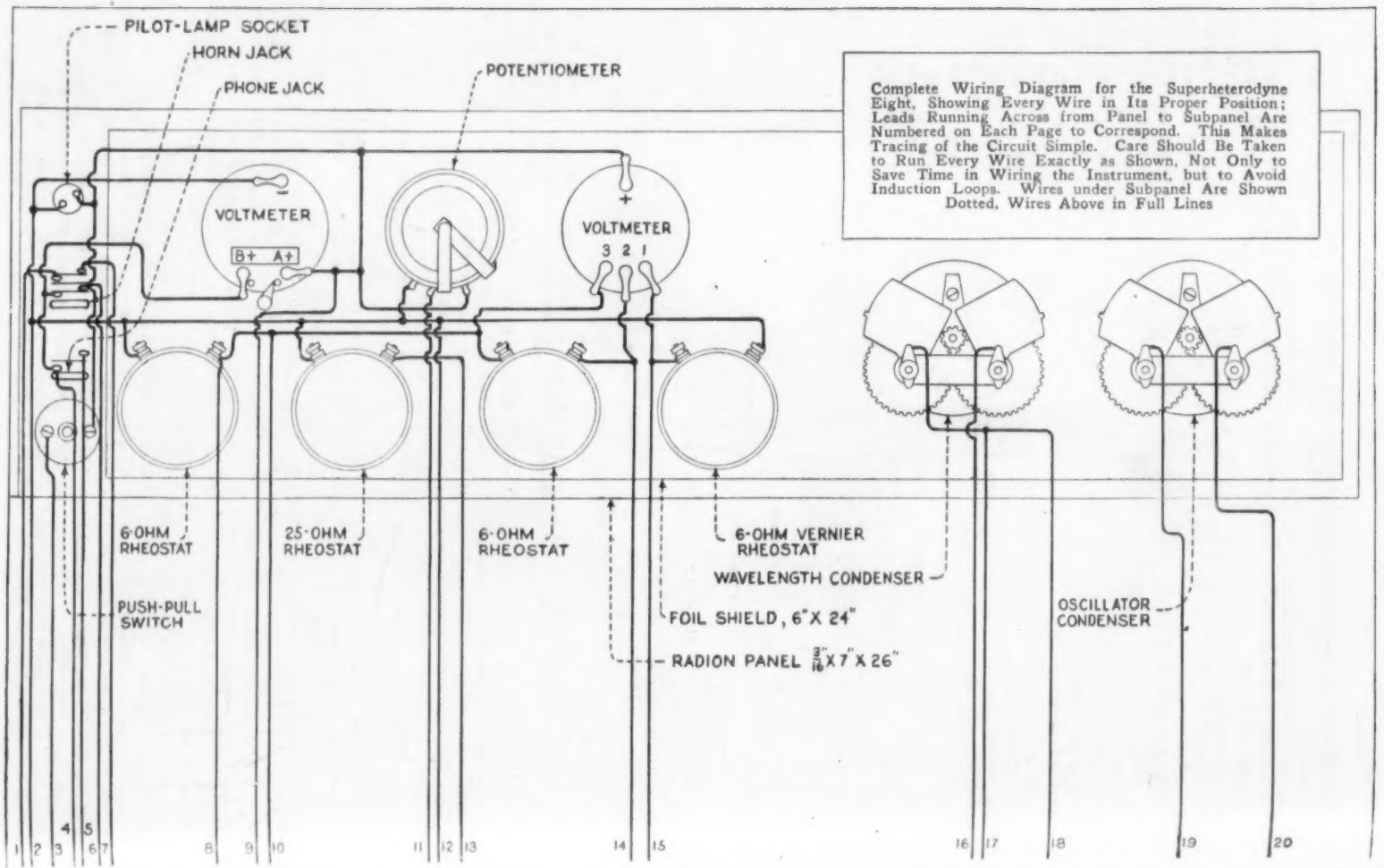
the third bracket is also placed under the grid terminal and provides a mounting for one side of the .0005-mfd. grid condenser and the 2-meg. grid leak, which is mounted on clips attached to the grid condenser. This assembly is clearly shown in the wiring diagram. Place soldering lugs under every terminal on transformers and sockets, and also put lugs on all fixed condensers not furnished with them. These lugs can be attached to the condensers by means of short brass machine screws. Never solder directly to any condenser of this type, as the heat from the iron will destroy the efficiency of the condenser.

The .5-mfd. by-pass condenser is placed flat under the second detector-tube socket, with the terminals toward the front panel, making connection easy to the lever of the potentiometer and the negative-A line. Directly back of the audio-frequency transformers, at the back edge of the subpanel, mount the brackets for supporting the terminal strip. These are made of 1/16 by 1/2 by 4 1/4-in. brass strips, turned up 1 in. at each end and drilled as shown in the detail Part I. Fasten them to the subpanel with brass machine screws. The terminal strip consists of a piece of 3/16 by 1 by 7-in. bakelite. Drill this strip for the binding posts and engrave the various B-battery voltages as indicated on the strip. Place soldering lugs under these posts and mount the strip on top of the brackets with short brass machine screws. The 1-mfd. by-pass condenser is connected across the B-battery from the A negative to B 90-volt posts. At the right of the terminal strip is a binding post on the subpanel; this post is for the positive lead of the 4 1/2-volt C-battery. A lead from the negative A-battery line is also run to the base of this post under the subpanel. This binding post is for convenience in wiring; the lead from the negative-A line to the positive of the C-battery can be taken direct, eliminating the binding post if so desired. This completes the instrument assembly of this section on the subpanel. A brass shield is then placed between this section and the next, as shown in the photos. The shield is made of 26-gauge sheet brass, 6 1/4 by 6 1/2 in. in size. The long side is bent at right angles 1/4 in. from the end, to form a mounting base for the shield; two holes are drilled through the flange, and the shield is secured to the subpanel with short machine screws. A soldering lug is placed under one of the machine screws on the underside of the subpanel for the purpose of grounding the shield. This applies to both shields and the tinfoil shield on the back of the front panel is grounded by means of lugs under the brass supporting brackets that go under the subpanel. The lugs are all connected together with one wire which runs to the negative binding post of the A-battery. This is done after all circuit wiring has been completed.

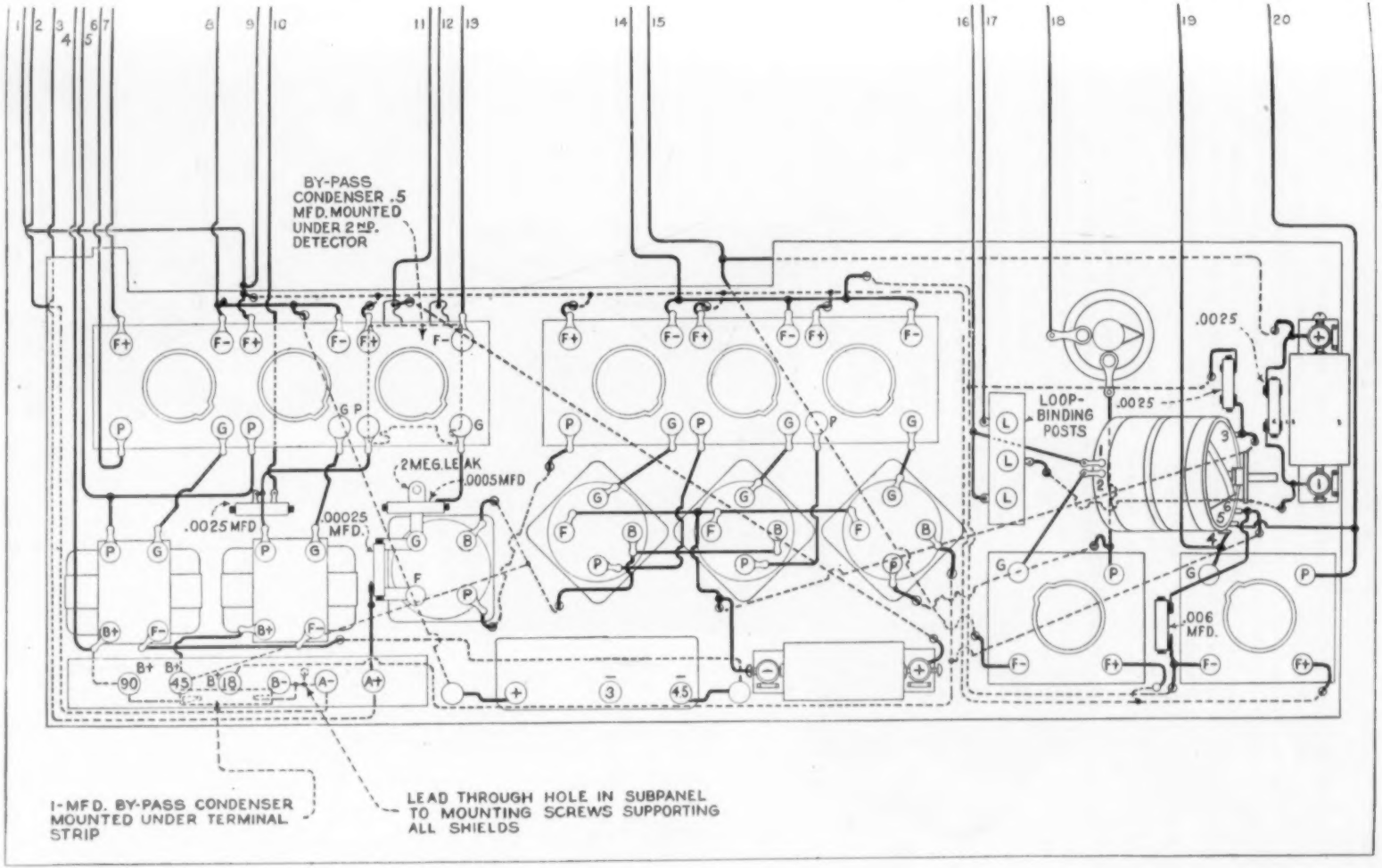


Details of the Mounting of the Loop on the Top of the Cabinet, Showing the Connections to the Binding Posts

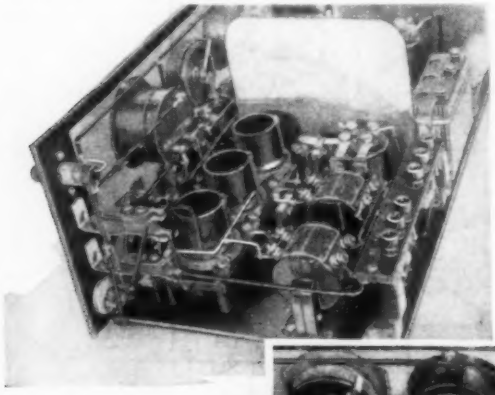
We will now consider the middle section; this embraces the three intermediate-frequency transformers and their respective tube sockets, also the 4 1/2-volt C-battery, the 1 1/2-volt C-battery for the potentiometer and the negative lead to the filament posts of the intermediate-frequency transformers. The filament posts of these transformers are all connected together with one bus bar, and this lead is taken to the negative post of the 1 1/2-volt battery. The binding post shown between the two C-batteries in this section is for the negative lead from the 4 1/2-volt C-battery, which goes to the filament posts of the two audio-frequency amplifying transformers. The 1 1/2-volt C-battery consists of a cell from a flashlight battery, and is

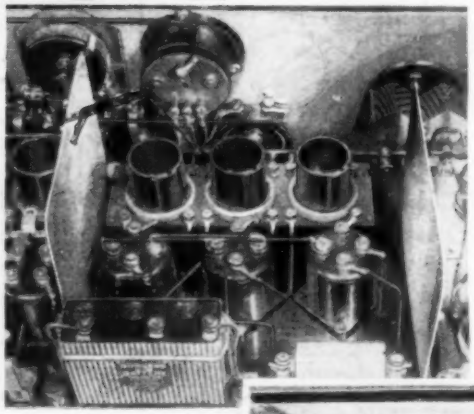


Complete Wiring Diagram for the Superheterodyne Eight, Showing Every Wire in Its Proper Position; Leads Running Across from Panel to Subpanel Are Numbered on Each Page to Correspond. This Makes Tracing of the Circuit Simple. Care Should Be Taken to Run Every Wire Exactly as Shown, Not Only to Save Time in Wiring the Instrument, but to Avoid Induction Loops. Wires under Subpanel Are Shown Dotted, Wires Above in Full Lines


BY-PASS CONDENSER .5 MFD. MOUNTED UNDER 2ND. DETECTOR
2 MEG. LEAK
.0005 MFD
.0025 MFD
.00025 MFD.
.0025
.0025
LOOP-BINDING POSTS
.006 MFD.
1-MFD. BY-PASS CONDENSER MOUNTED UNDER TERMINAL STRIP
LEAD THROUGH HOLE IN SUBPANEL TO MOUNTING SCREWS SUPPORTING ALL SHIELDS

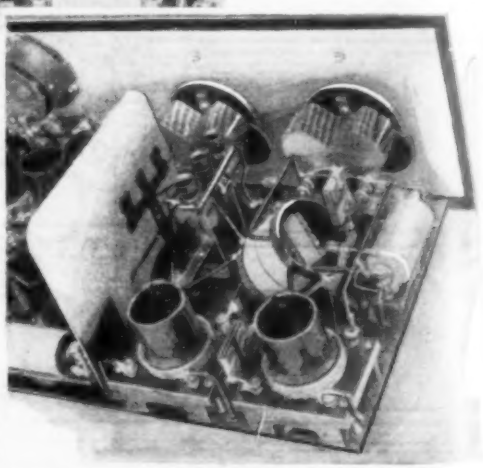
mounted on a 3/16 by 3/4 by 3½-in. strip of bakelite. Holes are drilled at each end of the strip for mounting double binding posts, of which the lower screws secure the leads from the circuit, and the upper ones hold two short lengths of bus bar or two No. 6-32 machine screws to support the dry cell and also make the positive and negative connections; a small brass nut is soldered to the zinc shell at the base of the cell, holding the cell in place by means of the bus bar. The positive contact is made at the other end of the cell by countersinking a very small hole in the brass positive terminal, just deep enough to allow the bus bar or screw to support this end of the cell and make a good contact. A hole is drilled through the center of the bakelite strip for a 1-in. brass machine screw, and a fiber washer is used to support the entire unit above the subpanel. The unit is then mounted in the position indicated. The intermediate-frequency transformers are mounted on the panel in the position shown, to allow the grid and plate leads to be made as short as possible. Next comes the second shield; this is exactly like the preceding one, and is mounted in the same manner, except that it is placed far enough back to clear the wave-length condenser. This completes the assembly of the middle or intermediate-frequency section.





The third, and last, section to the right contains the coupling unit mounted on the subpanel, and it will be noted that the soldering lugs on this unit are numbered as shown in the diagram. Care should be taken when soldering the wire to these small terminals; do not hold the soldering iron to them any longer than sufficient to make a good connection. At the left of the coupling unit is a 3/16 by 5/8 by 2½-in. strip of bakelite, on which is mounted three binding posts. This strip is mounted on a 1/8 by 1/2 by 6-in. bracket bent as shown so as to form a 1¼-in. base, and also bent for 3/4 in. at the top. This binding-post assembly is for the purpose of connecting the three flexible leads from the loop jack and cord-tip jack mounted in the top of the cabinet to their respective leads, as shown in the loop-connection drawing. Green silk-covered lampcord is very good for these leads; they should be just long enough to allow the lid of the cabinet to be opened, and can be bunched through a small screweye near the hinge of the cabinet.

The midget variable condenser is of the table-mounting type and is placed on the subpanel at a point directly between the oscillator condenser and the wave-length condensers on the front panel. When soldering the leads to this condenser, substitute lugs for the copper tabs and solder the wire to the lugs. At the right of the coupling unit



Above, View of Left-Hand Section of Subpanel; Center, Middle Section, and Below, Right-Hand End of Subpanel, Showing Location of Shields

is another of the 1½-volt batteries; this is mounted in the same manner as the 1½-volt C-battery previously described. There is a .0025-mfd. fixed condenser across this battery; this condenser is mounted on the battery unit with bus bar looped under the double binding posts.

At the rear of the subpanel in this section are the sockets for the first detector tube and the oscillator tube; these are of the single type and are mounted on the subpanel with brass machine screws, 1¼ in. long. The oscillator socket is mounted at the extreme right of the subpanel and the first detector socket at the left of the oscillator. This detector tube is of the C-300 or UV-200 soft type; all the other tubes used in the instrument are of the UV-201A or C-301A type. This completes the assembly of the oscillator and first detector section.

Complete all the wiring possible on the subpanel before attaching the front panel, then screw down the subpanel to the brackets already mounted on the front panel, and complete the wiring. Use tinned-copper bus bar for the entire circuit, and cover with a good grade of black "spaghetti" tubing. The leads from the switch points on the voltmeters can be made with smaller flexible rubber-covered wire if desired.

Keep the negative and positive A-battery leads underneath the subpanel and close together, so as not to form any induction loops in the circuit. This also applies to all other leads. Avoid forming loops; keep all grid and plate leads as short and direct as possible, and do not parallel grid and plate leads. All wiring under the subpanel is run direct from point to point. See that the machine screws that go through the subpanel do not touch the wood bottom of the cabinet. The brass brackets elevate the subpanel ½ in. above the cabinet base, and this allows plenty of room for all screws and wiring to clear the cabinet base. The instrument is now completed and ready to place in the cabinet.

Prepare the lid of the cabinet for mounting the loop jack by drilling a ¾-in. hole through the lid at a point just back of the center, then cut a disk of 3/16-in. bakelite, 3 in. in diameter, for mounting the loop jack; drill this for the oval-head nickel-plated wood screws, as shown in the diagram, and also drill a hole at the back of the center in this disk to mount a phone-tip jack for the center tap on the loop. This hole must be drilled so that the cord-tip jack clears the loop-jack flange. Drill another ¾-in. hole through the lid to clear the cord-tip jack. When the loop jack is mounted, no metal should come in contact with the lid. If the reader desires to log the loop there are extra paper-dial charts furnished with the oscillator and wave-length condensers, and one of these dials can be fastened under the bakelite disk that forms the mounting for the loop jack. A disk of celluloid covers the dial and prevents soiling, and at the same time tends to hold the paper dial flat on the cabinet; the loop aerial can then be rotated 190° and logged. When making the station log, enter the call letters of the station, then the wave length, then the reading on the oscillator condenser, next the reading on the wave-length condenser, and last the position of the loop. The loop is directional and helps materially in cutting out interference. To mount the loop on the loop-jack plug, cut off 1 in. of the fiber shell of the plug and make a wooden plug, 11/16 in. in diameter and long enough to come flush with the top of the loop plug when driven into the latter; then drill a hole through it from end to end to take a 5/16-in. brass dowel pin, 2¾ in. long, which is fitted snugly into the wooden plug and the latter is then pushed into the loop plug. This will then allow about 2 in. of the brass pin to stick up above the top of the loop plug, and as the end of the loop is already drilled to take a pin of this size all that is necessary is to place the loop on the pin and push the wooden plug into the loop jack. For those who would rather not mount their loop on the lid of the cabinet, but prefer to have the loop separate, a mounting base comes with the loop and this is provided with three double binding posts to take the three loop leads. If this is used, the three leads from the binding posts mounted on the subpanel must be brought out through holes drilled in the rear of the cabinet. This completes the loop installation. If desired, a pointer taken from an old rheostat can be soldered to the bottom of the loop-jack plug to work over the paper dial on the cabinet top. This will assist in logging the loop.

Remove the loop, and drill holes through the rear of the cabinet in line with the binding posts for the A and B-batteries. Small hard-rubber bushings, such as are used in the bases of electric table lamps, are shellacked into the holes. These are not essential, but add much to the appearance of the cabinet. Use flexible rubber-covered fixture wire for connecting the A and B-batteries to the binding posts. The A-battery consists of a 6-volt 80-amp.-hr. storage battery, and the B-

battery of either four 22½-volt heavy-duty B-battery units, or two 45-volt units. These are connected in series and tapped off at the first 18-volt positive tap for the plate of the first detector tube and the plate of the oscillator tube; this will be seen by referring to the checking diagram. The 45-volt positive B-battery tap is for the plate of the second detector tube and the plates of the three intermediate-frequency amplifying tubes. The 90-volt positive tap is for the plates of the two audio-frequency amplifying tubes. The instrument is then ready for the tubes.

Take one tube and place it successively in each socket, each time pushing in the push-pull filament switch and turning up the rheostats; this will show if there is any error in the filament wiring and eliminates the possibility of burning out all eight tubes. If the tube lights correctly, all the tubes can now be placed in their sockets, being careful to put the C-300 or UV-200 detector tube in the first-detector socket. Set the rotor of the coupling unit at the loosest coupling; see the photo for the approximate position. We are now ready to adjust the instrument under operating conditions.

Take the plug off the end of the loop and place the loop on the extra base that comes with it; take three flexible leads from the loop binding posts in the instrument out to the loop. This will permit the cabinet lid to be raised so that the midget variable condenser and the rotor of the coupling unit can be adjusted for best results under operating conditions. When these have once been set for maximum clarity and volume there will only be two variable adjustments to make in tuning; these are made with the oscillator condenser and the wave-length condenser, and, of course, the position of the loop in regard to the location of the station being received. The rotor of the coupling unit and the midget variable condenser will only require the first adjustment and need not be touched again.

To pick up a broadcasting station, turn up the rheostats to a point where you can hear the tubes in operation, then set the wave-length condenser at, say, the 30° point on the dial. Rotate the dial of the oscillator condenser 10 to 15° on each side of its 30° mark; if no station is heard on this wave length, reset the wave-length dial 5 or 10° ahead and follow the same procedure with the oscillator condenser as above until a station is located; repeating this process over the entire dial reading. If, after this tuning process, one is still unable to locate a station, the fault may lie in the fact that the oscillator tube is not oscillating. Turn up the rheostat marked oscillator and intermediate fre-

"A Marvelous Set! And It Seems Almost Too Simple. Why, I Believe I Could Build One Myself." This Was the Verdict of Mary McCormic, Famous Opera Star, on Viewing the Popular Mechanics' Superheterodyne Eight, the Sensation of the Chicago Radio Show

quency; this is the third rheostat from the right-hand side of the cabinet when facing the instrument; turning up this rheostat will usually remedy the trouble. Also turn up the first rheostat at the extreme right end of the cabinet; this rheostat is marked audio; it also operates as a power rheostat and on it depends the amount of filament current supplied to the oscillator and intermediate-frequency tubes. Another method of determining whether or not the oscillator tube is oscillating is to touch the grid terminal of the oscillator-tube socket with the finger; if the tube is oscillating, a distinct click will be heard when the terminal is touched and again when the finger is removed.

Left, the Shade Tipped Back and the Receiver in Use; Right, the Combination Used as a Lamp

If the instrument has been built according to the construction details outlined in this article one will not have long to wait for a station. Rotate the loop from time to time, as this will often enable stations to be picked up that otherwise may be unheard, as the loop is directional. After the instrument has been checked and properly adjusted for maximum results, take off the temporary loop leads and replace the loop plug on the loop. Close the cabinet and push the plug into the loop jack, and plug the center loop lead into the phone-tip jack. See that the loop plug makes proper connection in the jack; if it does not, the wave-length condenser will have no tuning value and it will be noticed at once. If the loop plug goes too far down in the jack, use washers between plug and jack, so that the plug will be of the proper length to make the correct contact in the jack.

Metallic Grid Leak Insures Permanent Resistance

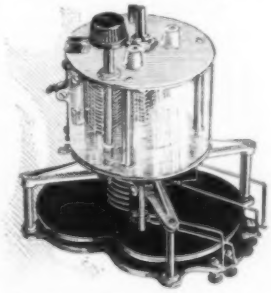
A metallic film of high resistance, which is actually annealed to a glass rod or tube, is the feature of a grid leak recently placed on the market. It is claimed that the resistance thus produced is unusually stable, due to the fact that the film cannot wear off, or become detached in any other way.

Instrument Combines Lamp, Receiver and Loud Speaker

A novel combination of radio receiver and table lamp has recently made its appearance and lends itself nicely to the decorative scheme of the home. The lamp and receiver are made in one unit, and the loud speaker is concealed under the shade. When the shade is tipped back, the receiver is exposed to view. The circuit comprises a detector and two-step amplifier, and has a wave-length range from 250 to 700 meters. The lamps are mounted at each side of the instrument cabinet.

Special Unit Aids in Building Tuned Radio-Frequency Sets

Tuned-transformer radio-frequency amplification has until recently been objectionable, on account of additional adjustments and the necessity of using some means of stabilizing or prevention of oscillation, most of which are not applicable over the whole broadcast range, and which accomplish the results with considerable loss in energy. Now, however, a tuned radio-frequency transformer has been made which is mounted on the shaft of the condenser, thus eliminating an additional tuning dial. The transformer is tuned simultaneously with the loop. Stabilization or oscillation prevention is obtained by means of another variable condenser, the required movement of which is only a few degrees and which acts in the capacity of a volume control. The transformer is wound so that the resistance is very low, giving equal amplification over the entire broadcasting range.



Radio Sets Affect Watches

Thousands of London watches have been attacked by a new disease, which jewelers have named "broadcastitis." They report that about 40 per cent of their repair cases are due to magnetism, as compared with five per cent before radio became popular.

American jewelers say there has been no appreciable increase in magnetic troubles in this country, the average remaining around five per cent. They suggest, however, that the English jewelers' diagnosis is probably wrong, and that not broadcasting, but listening, causes the trouble, the watch becoming magnetized while the owner is tinkering with his receiving set.

If you have alternating current in your home, a simple demagnetizer can be built with a broad base, 4 by 10 in., an electric light socket and lamp, a length

of extension cord and plug, and a coil of ordinary magnet wire, the light being connected in series with the coil to furnish the necessary resistance to protect the line fuses.

Prepare an oval form, 3 in. across the face, 2½ in. high and 3 in. long, and about this wind a half dozen layers of the magnet wire, shellacking the wire to give it the necessary rigidity to hold its shape. Line the inside of the hollow coil, after removing the form, with an old piece of plush or velvet, to protect the watchcase, and cover the outside with a strip of thin genuine or imitation leather. To make a neat-finished job, bevel the edges of the base, drill holes for the connection from coil and lamp socket, groove the underside of the board for the connecting wires, and, after wiring, cover the bottom of the base with felt.

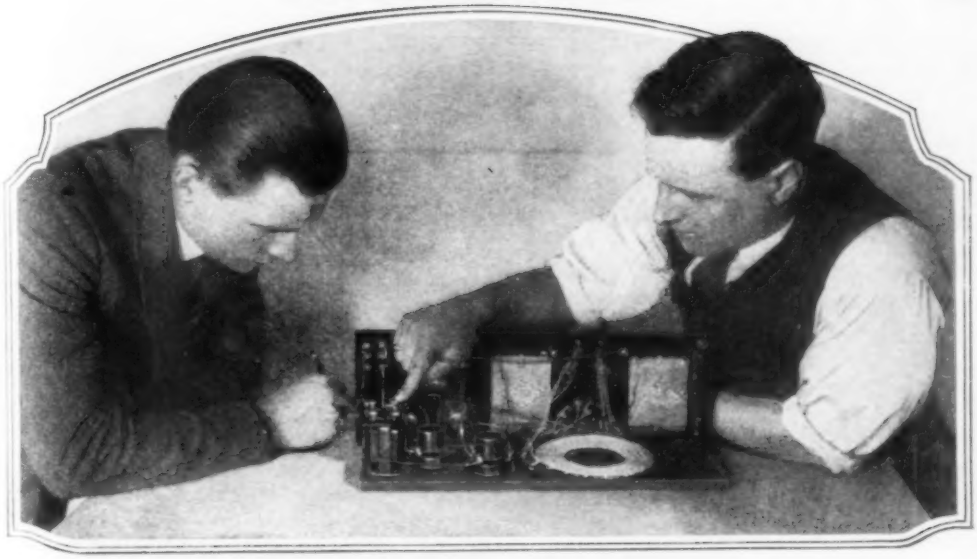
In operation the plug is screwed into the lamp socket and the current turned on. The sixty-cycle alternating current sets up a magnetic field in the coil. Pass the watch through it and the watch becomes the core of the magnet. Take it out, and the magnetism is removed.

Two Unusual Loop Aerials

The upper loop in the illustration is of German manufacture and contains some features not found in other loops. It is said that, owing to the auxiliary folding arms at the base, it is possible to tune the receiving instrument with this loop, as it can be folded into several shapes, offering various degrees of selectivity. It is wound with litz wire, and the arms keep the wires taut while folding.

The loop shown in the lower photo is radically different in design. Built in the shape of a balloon, or large ball, it is claimed to be very efficient and differs from the standard type of loop in that it is non-directional. It folds up in the same manner as an umbrella.

Above, New German Loop Folds into Various Shapes, Enabling the User to Tune the Set with It; Right, Novel Loop That Is Non-Directional



Things to Avoid in Building Sets

By J. D. ATKIN

THERE is nothing very hard about the building of a radio set, even an eight-tube superheterodyne. There are a few more instruments to mount on the panel and baseboard or subpanel, a few more wires to bend and joints to solder, than when building a simple 1-tube set, but, with a good diagram, that is all the difference. However, when building any set, from the simplest to the one that appears the most difficult, there are a few things that must be taken into consideration, if the finished job is to be satisfactory both from the standpoint of appearance and performance. One should not merely take a diagram of an instrument and follow it slavishly. Of course, there are sets in the building of which the instructions must be followed closely, if the operating results are to be satisfactory, but in such cases the directions usually specify this. But in average sets the parts can sometimes be rearranged to improve the looks. Care should be taken, when doing this, that the leads are not made longer, as a set that looks well will not in the end prove satisfactory if it does not perform well. The thing of first importance is to keep the leads short, especially the grid and plate connections, and, when attempting to redesign a set, many different arrangements of the instruments must be tried until the happy result of good appearance and short leads is attained. Perhaps the best method of showing what should not be done in building a radio set is to give a concrete example. The Reinartz receiver shown in the full-page illustration is about the best example of "how not to do it" that has come to my attention for some time, though by no means a unique one. I have seen a good many receivers built by amateurs in the course of the last few years, and this set represents the average in de-

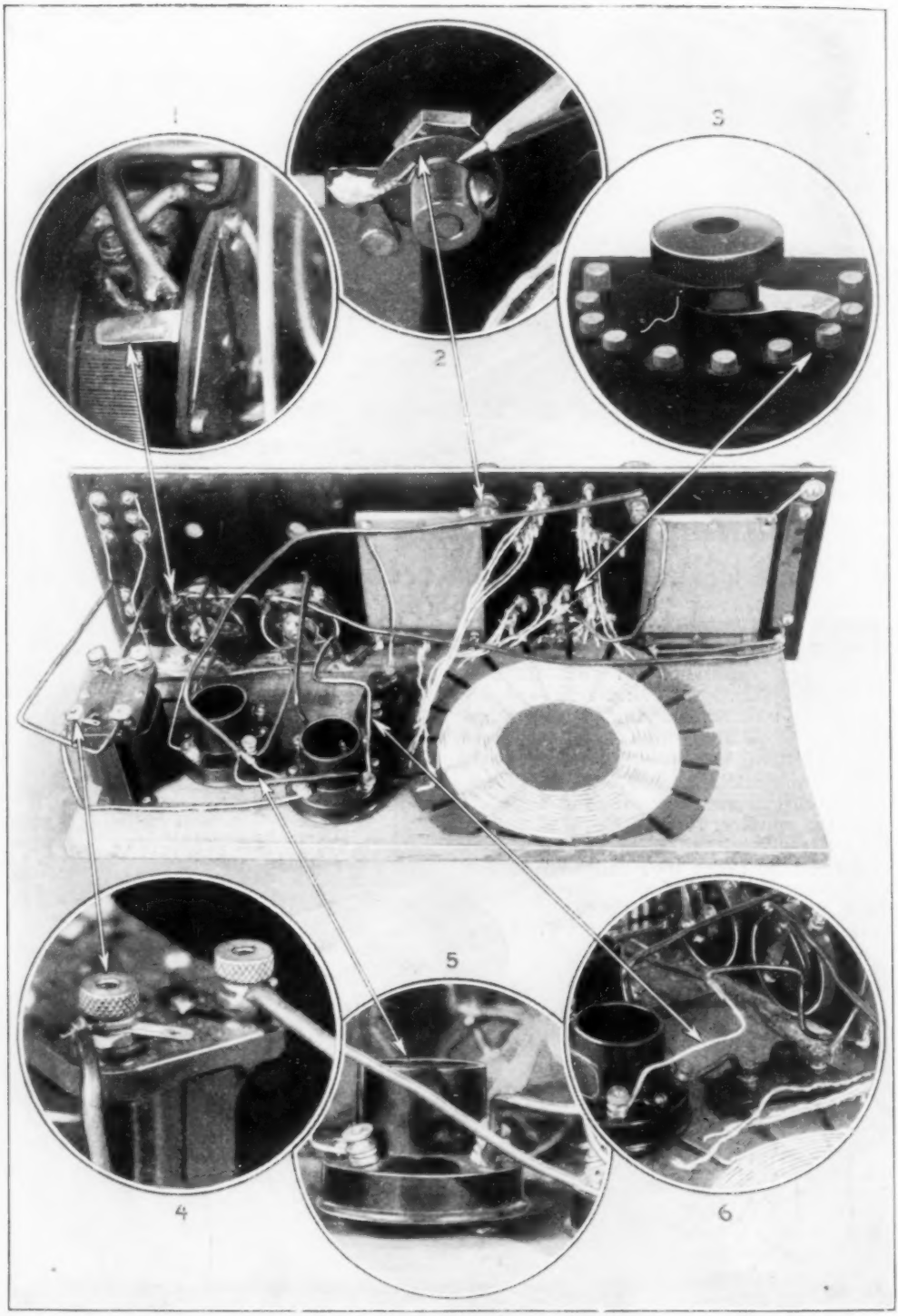
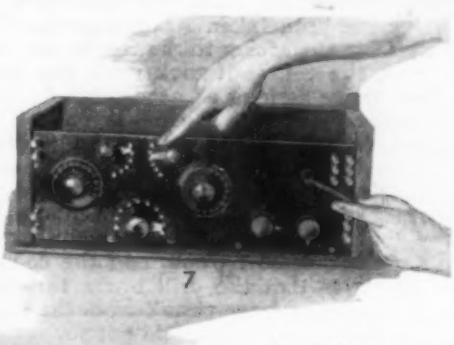


Fig. 1, Rheostat Shorted; Fig. 2, Bad Connection at Condenser; Fig. 3, No Contact at Switch Arm; Fig. 4, Transformer Leads Not Soldered; Fig. 5, Sockets Not Screwed Down; Fig. 6, Lead Far Too Long; Center, View of Rear of Set before Rebuilding

sign and arrangement of the first attempt. The wiring was atrocious; leads running every way but the right one, poor contacts everywhere—in fact, it is a tribute to the excellence of the circuit that the receiver worked at all. We will take up a few of the most important errors as they are illustrated in the enlargements in the circles.

In the first place, the owner could not understand why his batteries ran down so soon. He was using WD-11 tubes, and the filaments of these tubes do not light brightly, so that he did not notice that the second tube was burning all the time, whether the set was in use or not. Upon investigation, I found that the rheostat for this tube had been connected so that the switch lever, when it was supposed to be on the "off" point, really made contact with the other lead, forming a direct path for the current instead of shutting it off. This is shown in Fig. 1. Secondly, a slight jar was sufficient to cause the receiver to lose volume, and often to lose the station entirely. This, of course, pointed to a loose contact somewhere. As a matter of fact, there was not a tight contact anywhere in the set, all were loose, but the most conspicuous example of a poor contact was the one shown in Fig. 2. This is the connection from the switch lever of the secondary to one side of the tuning condenser. The copper washer that should have been clamped under that switch-lever bushing locknut was merely slipped over the bushing, and held in place by the shaft collar, thus making only an edge contact, and a very poor one. In addition to this, while the switch lever arms had at one time made good contact with the switch points, as was evident from the marks on the latter, now they did not; as shown in Fig. 3, one of the arms was about 1/16 in. from the points. No wonder signals had ceased to come in!



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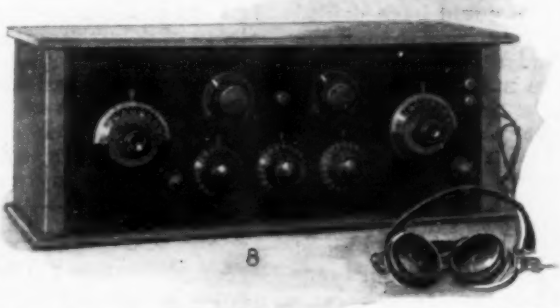

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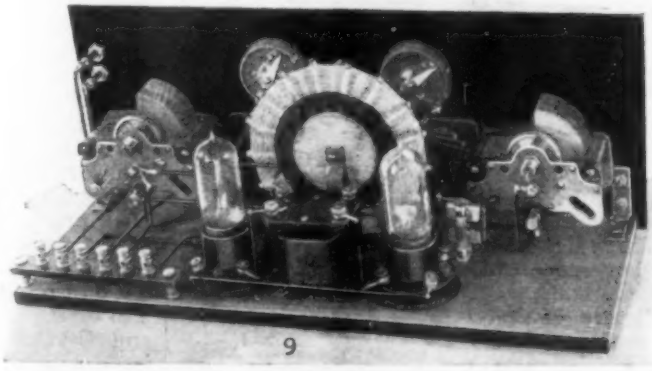

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Above, Front of Old Panel and Cabinet; Center, Front of Cabinet in Rebuilt Receiver; Below, View of Rear of Rebuilt Instrument, Showing Neat and Compact Arrangement

Although soldering lugs had been provided on the terminals of the transformer, these had not been used, but instead the bus bar had been looped around the terminals. This would not have been quite so bad had the terminal nuts been tight, but, in common with every other terminal in the set, they were loose. (See Fig. 4.) Fig. 5 shows the condition of the tube sockets. In addition to the fact that soldering lugs had not been used on the terminals, the sockets were not even screwed down to the base. In explanation of this the builder said that he had not any screws of the proper length, and he thought, "it didn't matter, anyway." It is true that the absence of the screws would not cause the set to stop functioning, but it is an evidence of carelessness, and good radio sets cannot be built if care is not taken to do

as good a job on every part of the set as lies within the builder's power.

In Fig. 6 is shown a typical lead, the one running from the tube socket to one side of the tuning condenser. This takes a bend upward, then one toward the panel, another toward the left, toward the panel again and then down and into the condenser terminal. This lead could just as well have been taken straight across the base from the socket to the condenser. As it was, the course it took made the lead about twice as long as necessary.

Figure 7 shows the panel layout. The panel was cut too narrow for the cabinet, but the builder made it do anyhow, thereby making the job look sloppy even at first sight. When drilling the peepholes in the panel he had not supported the latter on a block of soft wood, and the consequence was that the drill broke through and knocked a large chunk from the edge of the hole. Even if he had not supported the panel properly, he could have drilled these holes from the front, and then, if the edge of the hole had chipped, the front would not have been marred. With reasonable care, and the use of a block of soft wood under the panel at the point where it is to be drilled, there is no excuse for the holes chipping at the edges or breaking out.

In Figs. 8 and 9 is shown the instrument as rebuilt. It will be noticed that the panel arrangement is symmetrical, and looks very neat. All the binding posts have been taken from the front and mounted on a neat terminal strip at the rear of the baseboard, and the phone posts have been replaced by a pair of phone-tip jacks. The set of six posts at the left side of the original panel were for three pairs of phones, and, besides making the poor appearance of the panel worse, this method connected the phones in parallel. Phones should be connected in series for best results, and this is a simple thing to do by means of some double binding posts. There is therefore no need to spoil the appearance of the panel with extra phone posts.

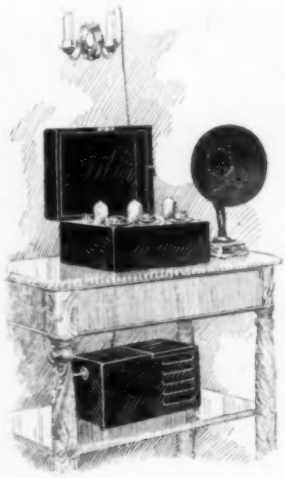
The condensers first used were of the book type, and while these were very good for fine tuning, the position of the dials could not be logged for various stations, since three turns of the dial were required to run the condenser from minimum to maximum capacity. Two good standard 23-plate condensers were therefore substituted for them, and, as these had a 100-to-1 vernier ratio, fine tuning was not sacrificed. Instead of drilling 22 holes in the panel for the switch points and stops inductance switches were used, which necessitated drilling only three holes. The old coil, which was badly wound and mounted on a thin fiber form, was thrown away, and a new coil, wound on a substantial wooden form, fixed in an upright position behind the inductance switches. The leads from the coil to the switches were thus made as short as possible. The rheostats were mounted on the panel at the top, with a filament switch between them. No peepholes were drilled, as, with the tubes employed, it is almost impossible to see when the filaments are lit through holes in the panel.

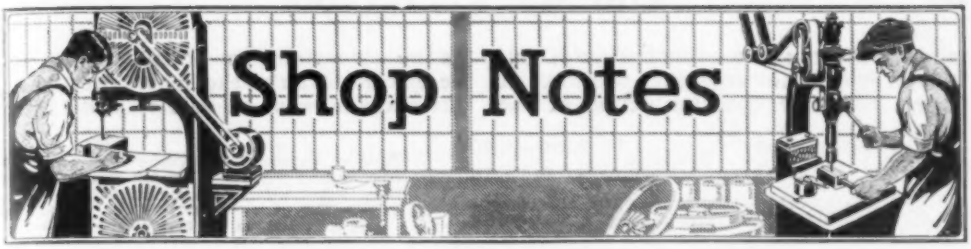
The new arrangement of the tube sockets and transformer is such that the plate and grid leads are very short and direct.

A little thought applied to the job before starting the construction of the set will often save time in the wiring of the instrument, as well as add greatly, in many cases, to its efficiency. This set, which would formerly hardly do more than bring in local stations on the phones, has now plenty of volume to operate a loud speaker on the same stations. Even if the operation of the set had not been very much improved, there is no question of the improvement in appearance, and this alone could easily have been achieved at first had the builder studied the circuit beforehand.

Receiver Operates on Lighting Current

A new receiver has recently made its appearance that can be operated from a wall socket on a supply of 110 volts, either alternating or direct current. The claim is made that the power is so controlled that it is quiet in operation, and unvarying in volume and tone. The A, B and C-batteries are eliminated. Combined with the power feature are two stages of condenser-tuned radio-frequency amplification, a detector and a two-stage audio-frequency amplifier. The tuning is simplified by synchronizing the three dials. One rheostat is used to control the five tubes as a unit.





All Shop Notes published in 1924, in book form—Fifty Cents—from our Book Department

Steam Sterilizer for Dairy Utensils

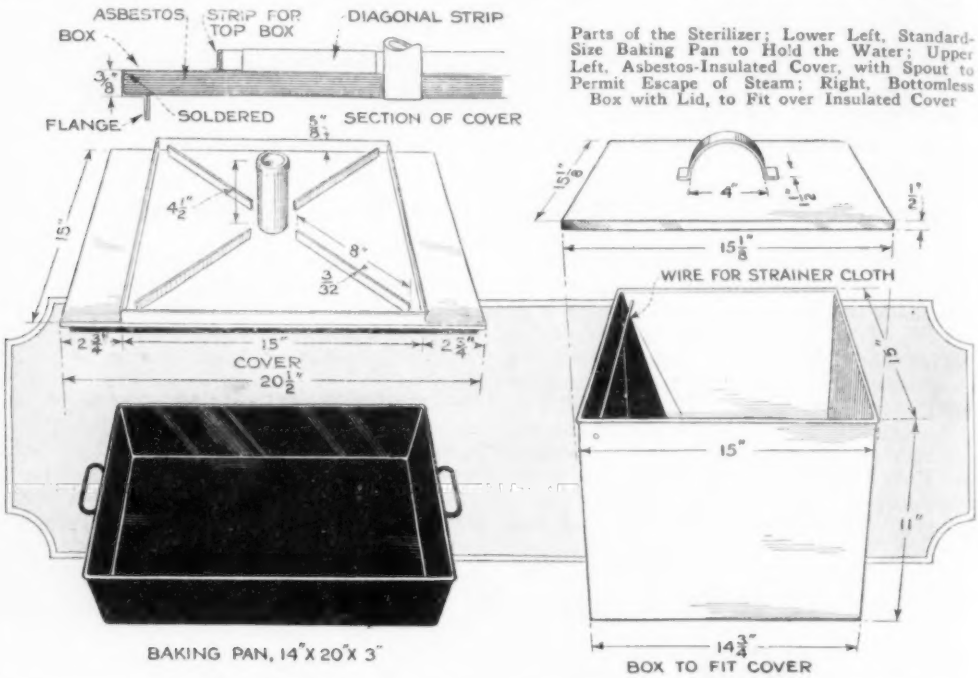
DAIRY utensils that are not kept scrupulously clean become a hotbed for germs, which not only cause the milk to sour quickly, but also may contribute to the spread of disease. Even though a milk can may seem perfectly clean after it has been thoroughly washed, sterilizing it by means of the simple apparatus described in this article will greatly increase the time that milk can be kept in it without spoiling. This handy sterilizer, which is especially adapted to the needs of the average farmer who delivers two or three 10-gal. cans of milk daily, and uses a cream separator of the usual type, consists of four parts.

A baking pan of standard size, 14 by 20 by 3 in., is one of them, and a close-fitting, insulating cover should be made for it, as follows: The edges of a sheet of medium-weight galvanized iron, ¾ in. longer and wider than the top of the pan, are bent up ⅜ in. at right angles to form a shallow tray. This is filled with a number of

This Simple Steam Sterilizer Costs Little and Will Soon Pay for Its Cost Many Times by Keeping the Milk Sweet Much Longer Than Usual, Due to the Elimination of Germs; Milk Cans Are Set over the Spout for a Five-Minute Steam Bath

asbestos sheets and a second sheet of galvanized iron is soldered over the top. A flange, made by doubling strips of the same metal and bending them over at right angles, is sweated on the underside along the edge to fit snugly into the baking pan. A 1½-in. hole is cut through the center of the completed cover, and a length of galvanized-iron pipe, about 4½ in. long, is fitted and soldered in the hole, as indicated. Diagonal strips, 8 in. in length, are sweated on across the top of the cover and also strips forming a 15-in. square, as shown in the detail. The remaining parts are a box without a bottom, which should fit snugly inside the square on the pan cover and a flanged lid for the box. Dimensions are given in the detail drawing. A heavy length of wire to hold strainer cloths is riveted and soldered near one side of the box, about ¾ in. from the top. All these parts are easily made, but if tools are not available, any tinsmith will do the work for a small sum. The cost of the material is about $7.

The heating plant for generating the steam is an ordinary two-burner kerosene or gasoline stove, which can be found on nearly every farm. Water is poured into the baking pan to a depth of about 1 in., and the insulated cover fitted over it. This quantity of water will furnish steam at 211° F. for about 50 minutes. As soon as the water boils, considerable steam will be ejected through the spout, over which the utensils must be held to scald them.



Parts of the Sterilizer; Lower Left, Standard-Size Baking Pan to Hold the Water; Upper Left, Asbestos-Insulated Cover, with Spout to Permit Escape of Steam; Right, Bottomless Box with Lid, to Fit over Insulated Cover

The steam must be allowed to reach a temperature of at least 205°, and preferably 210° or 211°. An accurate thermometer, reading to 212°, is necessary to determine the temperature. This is placed in the top of the steam spout, and sterilization of the utensils should not begin until the steam has reached the temperature specified. A five-minute steam bath will thoroughly sterilize the utensils.

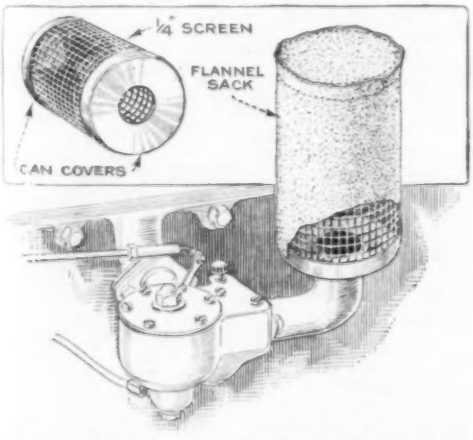
Milk cans may be put over the spout and left standing there until they are sterilized. When handling them, it is, of course, necessary to wear gloves or use cloth over the handles to prevent burning the hands. After sterilizing a can, it should be set, mouth up, so that the steam can readily escape. It will be dry in two or three minutes. The pails and separator tank are sterilized in the same way. Smaller articles are scalded in the box, which is placed on the cover and the lid put on. The strainer cloths are hung over the wire support provided for this purpose. It is unnecessary to rinse out the cans before filling them with milk; in fact, this procedure is inadvisable, as it partly defeats the purpose of the sterilizer.

As it is desirable to keep the cans and pails hot long enough to permit them to

sirv out without wiping, they should be covered with a sterilized blanket if the room is cold. If they do not dry entirely in this way, they must be wiped, or germs may begin to develop at once. After sterilization, the utensils should be kept in a room free from dust and should not be touched, especially on the inside. When a kerosene or gasoline stove is used, the milk should not be stored in the same room or it will absorb the odor of the oil.

Dust Filter for Tractor Carburetor

While shelling and threshing, we discovered that much of the dust and chaff blown around found its way into the carburetor and from there into the cylinders of the tractor, which increased the carbon deposit on the pistons and in the cylinder heads considerably. To overcome the difficulty, we made a filter of the kind shown in the illustration. It consisted of ¼-in. wire mesh bent to form a cylinder and soldered into two baking-powder can covers. The seam was also soldered. A hole was cut in one of the covers and this set over the intake of the carburetor. Several sacks were made from light-weight canton flannel, just large enough to fit over the screen cylinder snugly. These sacks were cut and sewed the wrong side out and then turned so that the nap would be on the outside. One of these was pulled over the screen and left there until pretty well covered with dust, of which very little got through. Then another was used until it too was covered, and so on. The sacks can easily be washed and are good for a long time.—Dale R. Van Horn, Walton, Nebraska.



Simple Filter Attached to Carburetor Intake Prevents Entrance of Dust and Increases Life of Motor

Truck for Moving Long Bars

When a long, heavy metal bar is brought from the shop storeroom, it is usually dragged along with one end on the floor and this, of course, mars the floor and is dangerous to the other workmen. Both of these objections can be overcome by using a small roller truck of the kind shown in the illustration and photo. It consists of a short length of pipe or tubing, drilled near one end for a shaft, which carries the wheels, a washer and pin at each end being used to hold them in place. In use, a bar is slipped into the pipe and it can then readily be pushed along.

Small Roller Truck Facilitates Moving Long Metal Bars

Sulphur Strengthens Concrete

It has been found that concrete soaked in melted sulphur is five to ten times as strong as ordinary concrete and is also waterproof. Concrete is so porous that it will absorb a quantity of hot melted sulphur equal to about seventeen per cent of its weight, and after the pores are filled with sulphur the concrete is resistant to compression. The tensile strength is also increased by this treatment. Although sulphur has a tensile strength of only 200 lb. per sq. in. and ordinary concrete often less than this, test pieces soaked in sulphur have been found to have a tensile strength of 2,000 pounds.—Chas. F. Goldthwait, Stratford, Conn.

Draftsman's Instrument Shelf

One of the disadvantages of a tilting drawing board is the lack of adequate facilities for keeping the ink bottle and the instruments from sliding down when the table is in an inclined position. The accompanying illustration shows a convenient shelf that will always remain horizontal irrespective of the angle of the table. The shelf may be of any desired length and is pivoted to the top edge of the drawing board by means of two hinges as indicated in the detail. On either end of the shelf a piece of flat iron is fastened to the edge, with an iron-rod extension made to carry a weight, which is tightened on the rod with a setscrew. The low center of gravity of this arrangement assures a level shelf for the ink bottle and the instruments no matter at what angle the board may be tilted.—J. H. Rodgers, Toronto, Can.

Shelf Pivoted to Top of Drawing Board Always Maintains a Horizontal Position

Paint Keeps Lime Plaster from Setting

That oil paint applied to the surface of fresh lime plaster tends to hinder the setting of such plaster, is one of the conclusions drawn from a series of tests made by the bureau of standards. The setting of the plaster is caused by the absorption of carbon dioxide from the air and the resulting change of the hydroxide, or slaked lime, into limestone.

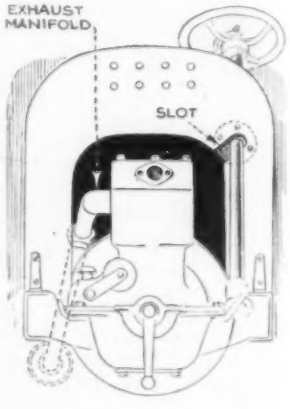
This absorption of carbon dioxide is very greatly hampered by the paint film, the bureau finds. It is retarded, but not seriously, by a finish coat, and takes place more rapidly in lean mortars than in rich. The combination of a finish coat with a film of oil paint on top of it was subsequently tried, and was found to prevent the absorption of carbon dioxide almost entirely, cubes of plaster treated in this way showing no appreciable penetration of carbon dioxide after six months.

Rustless Water Pipe

Iron water pipe can be made rustless by coating it with melted asphalt. The pipe is held up by two forked sticks, 3 ft. and 5 ft. in length respectively, the lower ends being pointed and driven into the ground about 12 ft. apart. The pipe is laid in the crotches and melted asphalt is poured into the upper opening. The asphalt is heated in a can until it boils and it is then slowly poured into the pipe, which should be turned while pouring. A pail should be placed at the lower end of the pipe to catch the asphalt that runs through. The pipe should, of course, be thoroughly cleaned before this treatment; if it is full of rust and dirt a wire brush should be drawn through first.—C. F. Goodnow, Jr., South Sudbury, Mass.

Removing Ford-Truck Engines

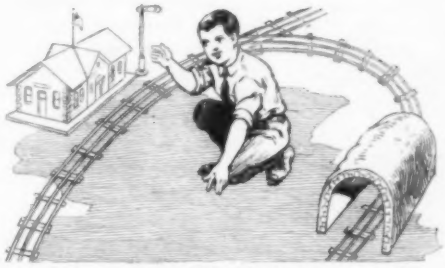
Considerable difficulty usually attends the removal of the engine from a Ford truck due to the interference of the dash and of the exhaust-pipe connection. In an eastern shop maintaining a number of these trucks, the trouble was overcome by sawing a slot in the dash from the inside to the steering post, as shown, so that the dash can be taken off without loosening the steering post. The exhaust and muffler pipe are pulled out as a unit by disconnecting the clamps that hold the manifold to the cylinder block. It is then an easy matter to remove and replace the engine.—G. A. Luers, Washington, D. C.

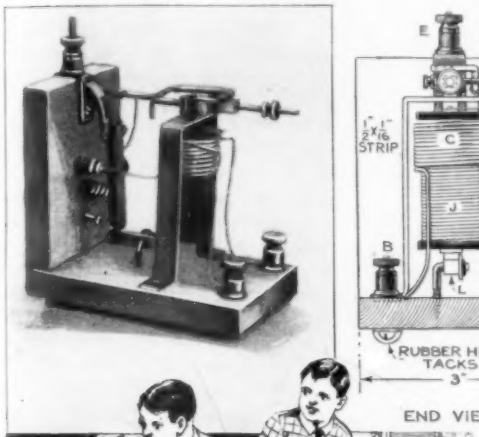


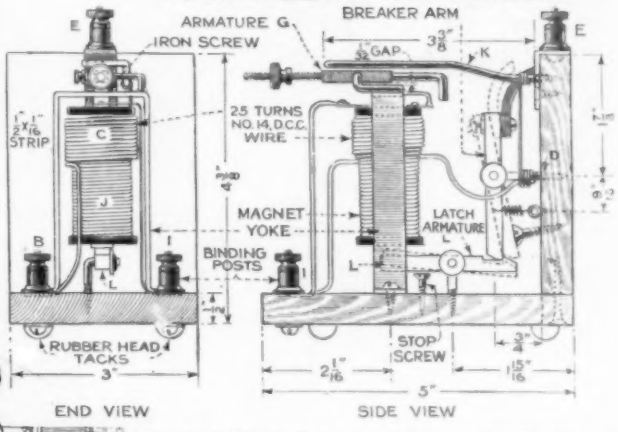
Making a Simple Circuit Breaker

By FRANCIS G. LeMERLE

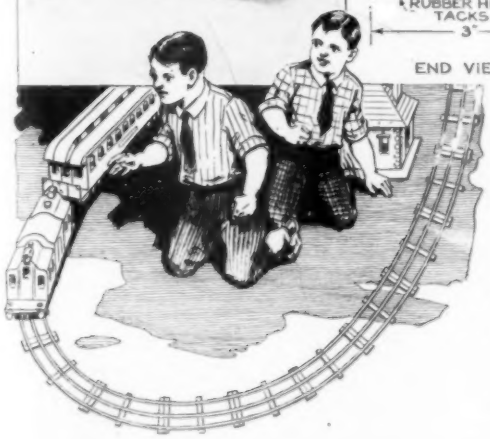
EVERY electrical experimenter and small-shop man has, at some time or other, occasion to use an overload circuit breaker, which automatically opens the circuit when the load becomes too great or a short circuit occurs. It will be found useful, for example, on miniature railroads which are often run on the current supplied by a 6-volt storage battery. A circuit breaker protects the battery from







Overload Circuit Breaker, Made from Readily Obtainable Parts, for the Electrical Experimenter

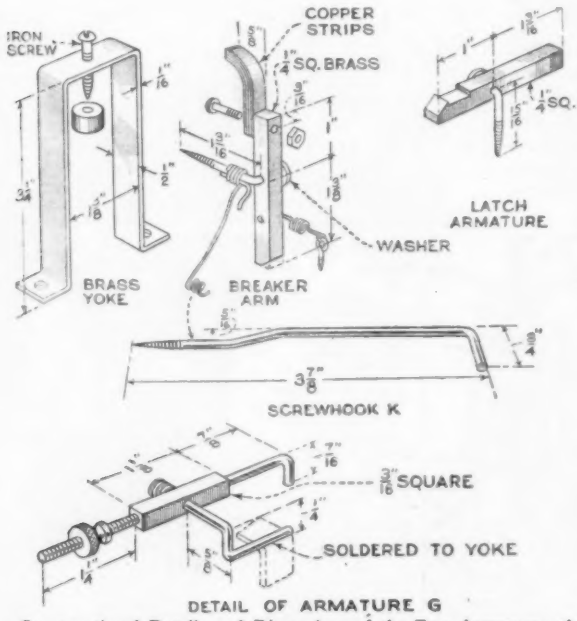


excessive discharges and prevents the tracks and trains from being burned due to short circuits, which occur frequently when the trains are derailed.

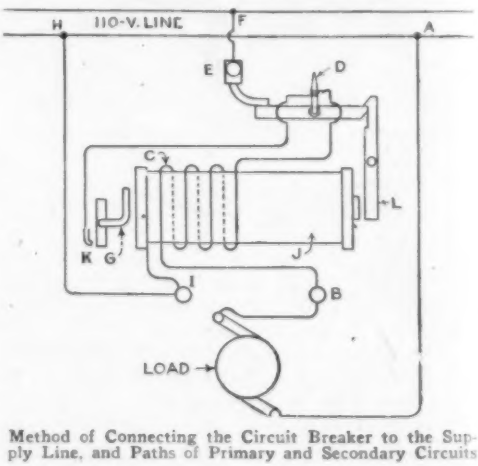
The breaker described in this article can be used on any voltage up to 110 and is very sensitive in opening a circuit carrying from 2 to 10 amp. It consists of a base and side of wood on which the metal parts are fastened; an old 500-ohm telephone-ringer magnet, and some miscellaneous parts that can readily be found almost anywhere and modified to suit their particular purpose in the device.

The telephone magnet J is held vertically by a brass yoke, ½ in. wide and 1/16 in. thick, bent as indicated in the detail. The feet of the yoke are drilled for wood screws, with which it is securely fastened down to the base, and the magnet is held to the top of the yoke by means of an iron machine screw driven into the core of the magnet, a hole being, of course, drilled and tapped for this purpose. Before fastening the magnet to the yoke, 25 turns of No. 14 d.c.c. wire are wound over the top end of the magnet, this winding being marked C in the drawings. The latch armature L is made of a short piece of soft iron according to the dimensions shown in the detail. It is drilled for a screwhook which, after being slipped through the hole, has a washer soldered on the end and is then driven into the base so that the heaviest end of the armature comes directly underneath the magnet core. A small stop screw is driven directly underneath to support the heavy end when it is not attracted by the magnet. The other end of the armature is normally raised and holds the breaker arm so that there is constant contact between the copper strips on the upper end of the arm and a plate which is screwed to the top of the side and is in electrical contact with terminal E.

The construction and dimensions of the breaker arm are given in one of the details. It is pivoted on a screwhook D, which is driven into the side. The copper strips, cut from No. 30 sheet copper, are curved and bolted to the top end of the breaker arm, and the ends filed down evenly to make a good electrical contact with the plate. A small coil spring is used to pull the breaker arm to the position indicated by the dotted lines in the side view when released from the latch armature. A stop screw is also provided here to arrest the arm. The armature G is then made. This is a short piece of 3/16-in. soft iron, drilled at both ends and in the center, as shown, a machine screw being screwed into one end and a short length of heavy galvanized-iron wire soldered into the other end. Another short length of the same kind of wire is used as a pivot for the armature, and this is securely soldered to the top of the yoke. A small collar is soldered on this wire on each side of the armature to hold it in place, although only one collar is shown in the detail, for the sake of clearness. A knurled thumbnut is then fitted on the screw; this nut changes the balance of the armature and varies the sensitiveness of the circuit breaker, as will be explained later. The screwhook K is bent to the shape shown and is driven into the side. It comes directly over the armature G, permitting the outer end of the armature to touch it when attracted by the magnet. The gaps between it and the armature and between the armature and the iron screw below should be about 1/32 inch. Three binding posts are provided to permit the device to be easily connected in any circuit; the binding post E is located on the sidepiece and, as mentioned previously, is electrically connected with the plate that makes contact with the copper strips on the breaker arm. The binding posts B and I are fastened on the base; one end of the 25-turn coil C is connected to binding post B and one end of the fine-wire coil J of the telephone magnet is connected to binding post I. The other end of the magnet winding is soldered to the brass yoke and the other end of coil C is soldered to screw D and to screwhook K. Screwhook K must not touch the plate under binding post E, or the circuit breaker will not function. Rubber-head tacks are provided under the base, and the circuit breaker is then ready for operation. The circuit diagram shows how the breaker is hooked up to the load and to the supply line. The binding posts E and I are connected to opposite sides of the line. The post B is connected to one terminal of the load and the other terminal of the load is connected to the same side of the line as binding post I, or it may be connected to this binding post if more convenient. The principle of operation of the circuit breaker is as follows: When the switch to the load



Constructional Details and Dimensions of the Two Armatures, the Breaker Arm, Brass Yoke and Special-Shaped Screwhook



Method of Connecting the Circuit Breaker to the Supply Line, and Paths of Primary and Secondary Circuits

is turned on, the normal current flows from point A on the supply line, through the load, through binding post B and coil C to pivot screw D; from here, it flows through the breaker arm, the copper strips and contact plate to binding post E, and thence to the other side of the supply line at F. If the current becomes too great or a short circuit occurs, coil C will magnetize the telephone-magnet core sufficiently to draw down the armature G against the iron screw. As soon as this happens, another circuit is closed which permits current to flow from point H, through the magnet winding, over the yoke, armature G and screw-hook K, to pivot screw D, and from there over the breaker arm, binding post E and to point F on the opposite side of the supply line. This secondary circuit strongly magnetizes the core of the telephone magnet so that the latch armature L is pulled up, and this releases the breaker arm, which consequently breaks the circuit. As soon as the breaker arm is released, the primary circuit to the load is broken and also the secondary circuit through the magnet J. Of course, this all happens in a fraction of a second so that the circuit is broken almost immediately when the overload or short circuit occurs. By changing the balance of the armature G with the thumbnut, the device can be adjusted to open at different currents; the closer the nut is screwed to the center the less magnetic force is necessary to pull it down and the less current is passed without operating the armature, and the farther it is out the more current required. As coil C has only 25 turns it cannot magnetize the core sufficiently to attract the latch armature.

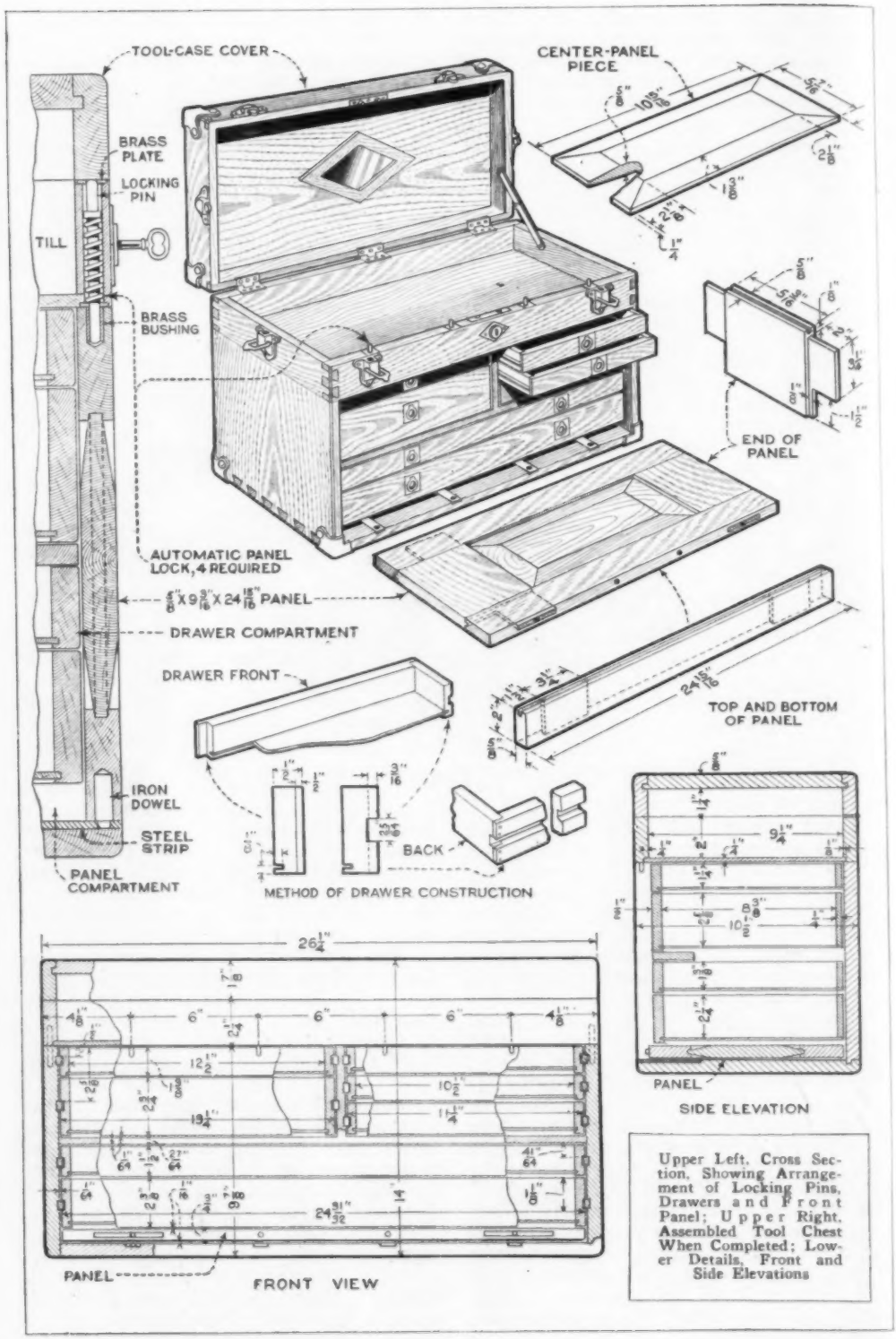
Simple Self-Feeder for Hogs Made from Old Reaper Bull Wheel and Oil Drum

Homemade Self-Feeder for Hogs

Many farmers will find a homemade self-feeder of the kind shown in the drawing just as useful as a purchased one. It consists of an old reaper bull wheel and an oil drum. Both ends of the latter are removed and the shell is wired to the wheel spokes as shown. As the wheel weighs over 100 lb., there is little danger of the drum upsetting. If all the spokes are left in, the feeder will be suitable for small hogs and pigs but if it is desired to use it for large hogs, one row of spokes must be removed, which can easily be done with the aid of a hammer and cold chisel. Of course, this feeder should be set on a flat surface of concrete or wood, preferably the former; better still, the bottom may be filled with an inch or two of concrete; in no case should it be set directly upon the ground as this would mean a very unsanitary condition. Incidentally, the rough lugs on the rim of the wheel offer splendid opportunity for itching hogs to get temporary comfort.

Coloring Brass Gray

To color brass gray, first clean the surface off with alcohol, polish it to an even finish, making sure that all grease and finger marks are removed, then immerse the work in a solution of arsenic chloride (poison), 1 oz., and water, 1 pt., until the desired shade is obtained. Wash in clean warm water, dry in boxwood sawdust, and warm and lacquer with a thin pale solution of bleached shellac in methyl alcohol, using a broad camel's-hair brush.—Frank N. Coakley, Buffalo, N. Y.



Upper Left, Cross Section, Showing Arrangement of Locking Pins, Drawers and Front Panel; Upper Right, Assembled Tool Chest When Completed; Lower Details, Front and Side Elevations

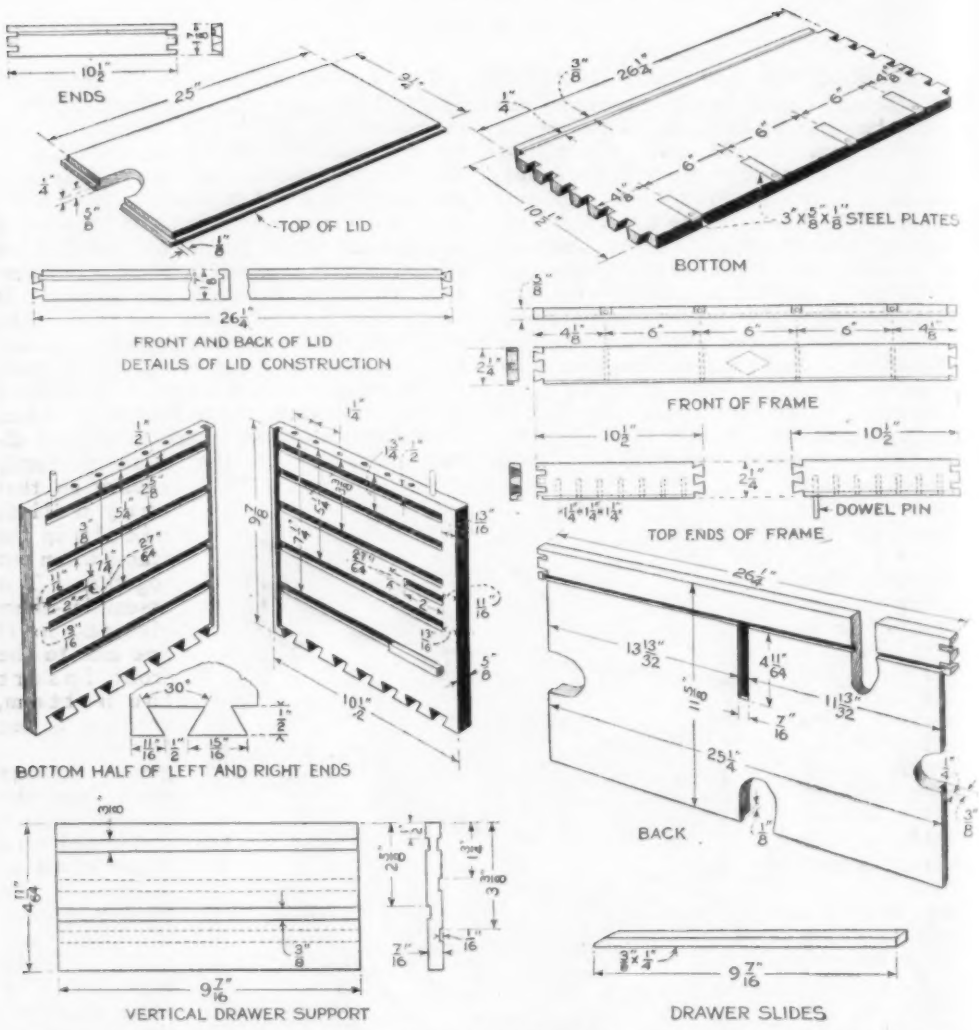
Durable Machinist's Tool Chest

By H. R. HARRIS

A STURDY oak tool chest, which will strongly appeal to any machinist, can readily be made by carefully following the constructional details and dimensions shown in the accompanying illustrations. The chest is 26¼ in. long, 14 in. high and 10½ in. wide, has a roomy till, 2 in. deep, seven drawers of various sizes and depths, and a removable front panel, which can be slid under the lowest drawer when the chest is opened for use. Besides being jointed in the neatest and most durable fashion, the corners are well protected by means of attractive brass chest corners. Four brass cover clasps, a strong, neatly designed lock, and drawer pulls greatly add to the finished appearance. When finished, the wood may be stained any desired color, preferably dark as this will not show spots as quickly as a light color, and filled with a paste. The surface should then be rubbed down with oil. It is not advisable to use paint, enamel or varnish, as any marks made by sharp tools are immediately noticeable. A practical feature of the chest are the locking pins provided in the front edge. These automatically lock the front panel when the cover is brought down and it is then impossible for anyone to get at the drawers. The construction of these pins is shown in the cross-sectional view of the chest at the upper left in the full-page illustration. Brass bushings are, of course, provided in the holes that are drilled in the top edge of the front panel to receive the pins.

Durable Machinist's Tool Chest Made of Oak, with Attractive Fittings and Designed to Accommodate All Kinds of Tools

The bottom and back of the frame are first cut out and fitted together, next the endpieces and then the horizontal and vertical partitions between the drawers. Finally the bottom of the till is cut, doweled and fitted in place. These parts are temporarily assembled and then taken apart, after which glue is applied and the parts securely screwed in place. The vertical partition between the drawers is screwed to the ends, back and till bottom, and horizontal drawer support with flathead screws, the holes being countersunk and plugged. The lid is cut and assembled in the same way. Care should be taken to make the drawer parts to correct dimensions, and all the joints perfectly square so that they will fit nicely in the frame when put together. To assemble them glue and nail one side to the front, insert the bottom, which is cut from No. 22 gauge sheet steel, into the groove; glue and nail the other side in place in the same way, and then glue and nail the back to the sides. The same construction is used on all drawers. Felt is glued to the drawer bottoms, and to all sides of the till, and a length of 1/16 by ¼-in. rubber strip is glued to the frame of the box behind each drawer, to take up the shock when the drawers are closed. Four 3-in. steel plates are screwed to the bottom, as shown, to take iron dowels provided on the bottom edge of the front panel. Although these plates are flush with the surface of the bottom, it is advisable in order to prevent marring the panel, to drive



Constructional Details of the Parts of the Chest, Including Bottom, Back, Ends, Front, Lid, Drawer Supports and Slides; the Parts Are First Cut and Fitted Together, Then Assembled with Glue and Dowels

round-head brass upholstery nails in the front of the panel at points where contact is made with the plates. For the sake of appearance, the front panel has a beveled center piece, which is fitted and glued in grooves cut in the sides and ends. After the chest is finished, it is advisable to apply some melted soap or grease on the drawer slides to reduce friction and prevent wear. As here described the box was built mainly of oak. The following parts in the material list, however, were made of maple: The first five items in the list; the top, front and back of the lid; the bottom, front and back of the frame; the drawer slides; the top, bottom and center pieces of the panel and the front of the drawers. When made of oak and maple, however, the outfit is very heavy, in fact, it may be too heavy for many machinists unless they desire a particularly heavy box in order to stand rough treatment. While this is desirable where a machinist is on the road, and his tools must be shipped many times in the course of a year, in the majority of cases lighter woods than these can be used with no great loss in wearing quality. Beech is much lighter than either oak or maple, and takes a very fine mahogany finish. Poplar, elm and chestnut are also very good woods to use, and comparatively light. Even the soft woods, such as pine or cypress, can be used if a very light box is desired, but this is not

MATERIAL LIST

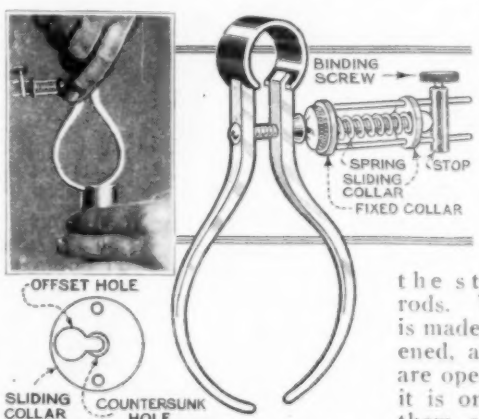
2 pieces, 5/8 by 9 7/8 by 10 1/2 in., bottom half, frame end.
2 pieces, 5/8 by 2 1/4 by 10 1/2 in., top half, frame end.
2 pieces, 5/8 by 1 7/8 by 10 1/2 in., ends of lid.
1 piece, 27-64 by 2 by 25 1/2 in., horizontal drawer support.
1 piece, 7-16 by 4 11-64 by 9 7-16 in., vertical drawer support.
1 piece, 1/4 by 9 5/8 by 25 1/4 in., till bottom.
1 piece, 5/8 by 9 1/2 by 25 1/4 in., lid top.
14 pieces, 1/4 by 2 7-16 in., dowels.
1 piece, 5/8 by 10 1/2 by 26 1/4 in., frame bottom.
1 piece, 5/8 by 2 1/4 by 26 1/4 in., frame front.
1 piece, 5/8 by 11 5/8 by 26 1/4 in., frame back.
2 pieces, 5/8 by 1 7/8 by 26 1/4 in., lid back and front.
14 pieces, 1/4 by 3/8 by 9 7-16 in., drawer slides.
1 piece, 5/8 by 5 7-16 by 15 3-16 in., panel center.
2 pieces, 5/8 by 2 by 24 15-16 in., panel top and bottom.
2 pieces, 5/8 by 5 by 9 3-16 in., panel ends.
1 piece, 1/4 by 1 1/4 by 13 in., upper-left drawer, back.
1 piece, 1/4 by 2 5/8 by 13 in., lower-left drawer, back.
1 piece, 1/4 by 1 1/8 by 11 in., upper-right drawer, back.
1 piece, 1/4 by 1 1/8 by 11 in., middle-right drawer, back.
1 piece, 1/4 by 1 31-32 by 11 in., lower-right drawer, back.
1 piece, 1/4 by 1 1/8 by 24 23-32 in., upper long drawer, back.
1 piece, 1/4 by 2 1/4 by 24 23-32 in., lower long drawer, back.
1 piece, 1/2 by 1 3/8 by 13 1/4 in., upper-left drawer, front.
1 piece, 1/2 by 2 3/4 by 13 1/4 in., lower-left drawer, front.
1 piece, 1/2 by 1 1/4 by 11 1/4 in., upper-right drawer, front.
1 piece, 1/2 by 1 1/4 by 11 1/4 in., middle-right drawer, front.
1 piece, 1/2 by 1 39-64 by 11 1/4 in., lower-right drawer, front.
1 piece, 1/2 by 1 1/2 by 24 31-32 in., upper long drawer, front.
1 piece, 1/2 by 2 3/8 by 24 31-32 in., lower long drawer, front.
2 pieces, 3/8 by 1 3/8 by 9 in., upper-left drawer, ends.
2 pieces, 3/8 by 2 3/4 by 9 in., lower-left drawer, ends.
2 pieces, 3/8 by 1 1/4 by 9 in., upper-right drawer, ends.
2 pieces, 3/8 by 1 39-64 by 9 in., lower-right drawer, ends.
2 pieces, 3/8 by 1 1/2 by 9 in., upper long drawer, ends.
2 pieces, 3/8 by 2 3/8 by 9 in., lower long drawer, ends.
2 pieces, 8 3/4 by 12 3/4-in., No. 22 sheet steel, left short drawer, bottoms.
3 pieces, 8 3/4 by 10 3/4-in., No. 22 sheet steel, right short drawer, bottoms.
2 pieces, 8 3/4 by 24 15-32-in. No. 22 sheet steel, long drawer, bottoms.
1 leather suitcase handle with rings.
4 polished-brass spring-clasp cover fastenings.
1 chest lock for wood 5/8 in. thick.
1 piano hinge, 22 in. long, or 3 small butt hinges.
10 polished-brass drawer pulls (flush-ring type).
8 polished-brass box corners.
1 yd. billiard felt.
8 ft. 1-16 by 3/4-in. rubber strip.

recommended unless the box will not be subject to much knocking about or wear.

With the use of a good dye the softer woods can be finished to look nearly as well as the hardwoods. More care must be taken with the filling, staining, varnishing and rubbing, but the result is well worth the trouble.

A Transfer-Caliper Attachment

Converting an ordinary spring caliper into a transfer caliper, which is a tool often needed, can be simply done by means of the attachment shown in the illustration. It is made as follows: Two collars are made to slip over the ball on the end of the adjusting screw. One collar has one hole drilled in the center to clear the ball, while the other has this hole offset and breaking into a small hole in the center, the latter fitting the screw. This hole is countersunk on one side. A short piece of round rod, tapped on one end for a knurled setscrew, is used for a stop. Both collars and stop are drilled for two small slide rods; these are a tight fit in one collar and riveted over. A light coil spring is fitted between the collars. After slipping the attachment in place, the sliding collar — the outer one—is pushed to one side when it is over the ball and the spring holds the latter snugly in the countersunk hole. While the caliper is adjusted, the setscrew is loose and the stop slides on the rods. When the adjustment is made, the setscrew is tightened, and when the calipers are opened to clear the work, it is only necessary to close them again until the stop touches the ball to obtain the correct measurement. The stop must just touch the ball lightly.—Harry Moore, Montreal, Can.



Simple Attachment Converts Spring Caliper to a Transfer Caliper

Row of Sharp-Pointed Spikes Keep Birds off Railroad Signs

Protecting Railroad Signs

Hawks, buzzards, owls, parrots, and other large birds, which are very numerous in a certain section of Mexico, found railroad signs quite convenient roosting places, with the result that the reading matter on the signs was soon obliterated. The trouble was quickly eliminated by driving a row of large, sharp spikes into the upper edge of each sign. These kept the birds off.

Turning a Stiff Crankshaft

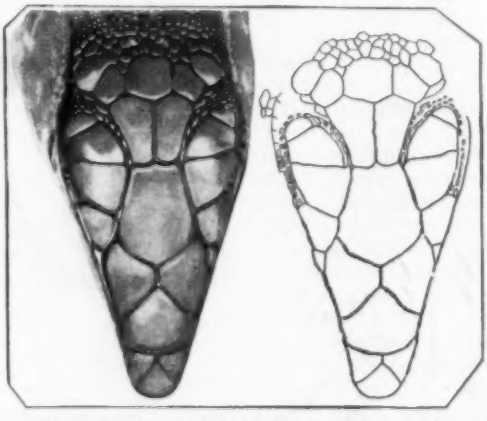
After bearings have been taken up, it is sometimes impossible to turn a crankshaft by hand or with the starter. If the car cannot be towed, the following method will be found satisfactory: Take an old rear radius rod, put 7/16-in. body bolts through the holes in the forked end and screw the nuts up tightly. The projecting ends of the bolts are spaced just right to enter the holes in the crankshaft flange, and the rod is long enough to give ample leverage so that it can easily be used to turn the crankshaft over.

Substitute for Welding Rod

While busy with a large welding job, which had taken several hours to preheat, we ran out of welding rod. The following day was a holiday and it seemed as if the work had to stop, which meant that the preheating would have to be done over again. Rather than lose so much time, we tried as a substitute soft-iron wire cut off from cotton bales that were on hand, and the results obtained were highly satisfactory. It is, therefore, a good idea to preserve old baling wire that otherwise would go to the scrap heap, as it may be found useful on similar occasions. — H. M. Toombs, Chicago, Ill.

Making Drawings from Photographs

Biologists classify snakes and other animals that have scaly skins by the arrangement of the scales on the head. At one time artists were employed to copy this arrangement, taking measurements with a rule and calipers. The present method of making such drawings is to photograph the object, trace over the picture with India ink and then bleach it. Any kind of paper may be used which has a semi-rough surface, the kind commercially designated as "semi-mat." The bleaching solution is as follows: Iodine (10 per cent in solution of potassium iodide), 30 drops; potassium cyanide (10 per cent in water), 5 drops; water, 1 oz. The solution is poisonous and should, therefore, be kept safe from persons other than the user himself or his assistants. This method of outlining photos may, of course, be used in other commercial and professional work. —C. W. Mitman, Washington, D. C.



Accurate Drawings Made by Tracing Photographs and Then Bleaching Them

New Method of Letting Stumps Burn Themselves Which Has Been Found Successful in Pacific Northwest and Has Received Endorsement of State Extension Service

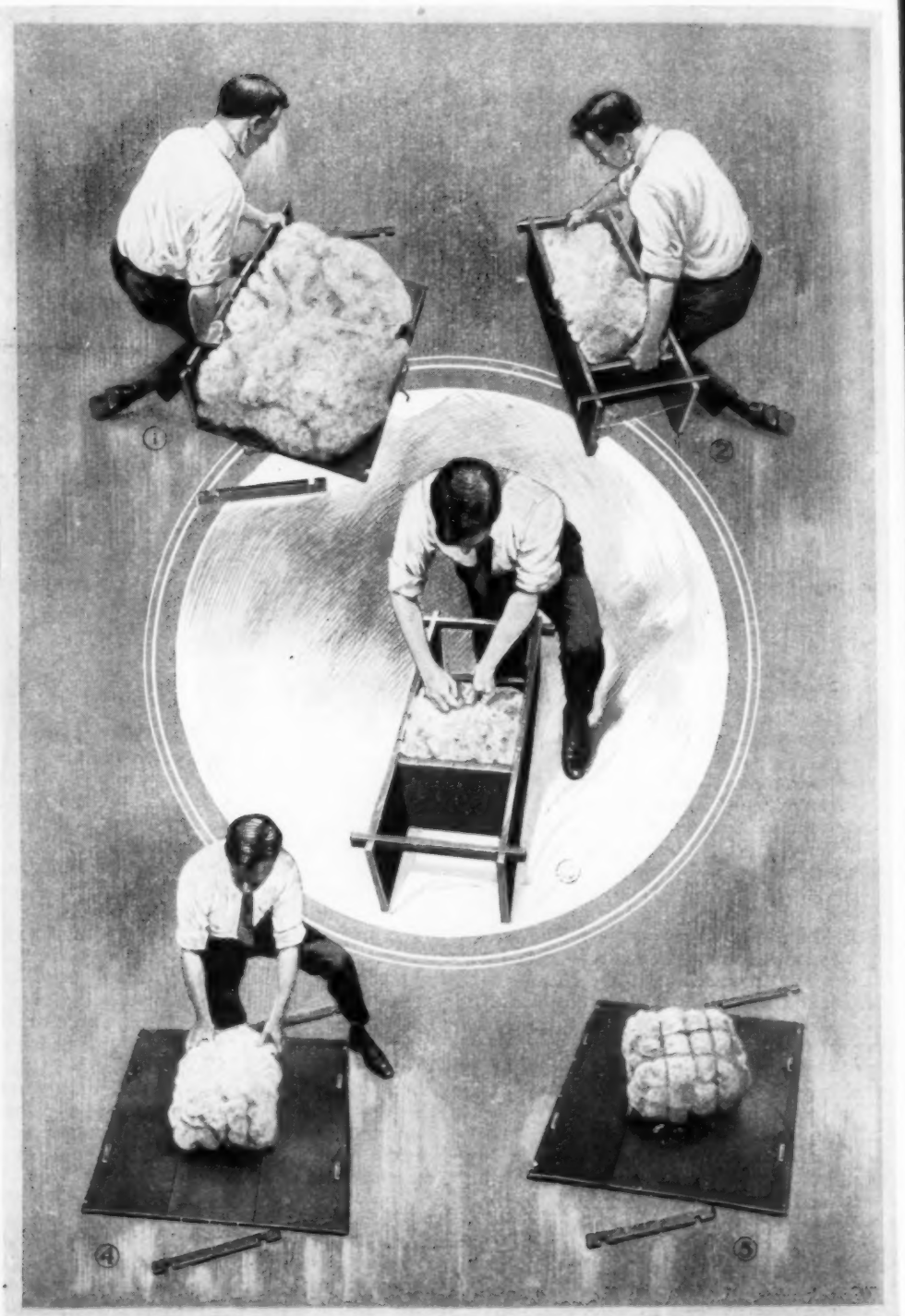
Making Stumps Burn Themselves

Removing large stumps from 2 to 8 ft. in diameter, standing as many as thirty to the acre, is a difficult task in the Pacific northwest. Every method of removing them has been tried, with varying success, but so far, not one of these methods has worked as well as a new burning method invented by an Oregon farmer. The burning apparatus consists of two cast-iron burners or furnaces, a long draft pipe, two short draft pipes and several lengths of ordinary 6-in. stovepipe. The outfit can readily be installed in a short time with the aid of a shovel, ax, furnace hook, iron punching rod and a wooden cleaning rod.

The furnaces are open at the bottom and rear, and a small door is provided at the front. One of them is placed on the ground with the rear end against the stump as shown in the photo. The long draft pipe is placed in the door, and pitch sticks and bark chips are laid over the end of the pipe inside of the furnace. A joint of stovepipe is next put in place and the furnace is banked in with earth to a depth of 12 to 18 in. After the kindling has begun to burn the furnace is filled with pieces of bark dropped in through the chimney and forced down with a poker. When the furnace is well filled, the long draft pipe is shoved further in, and causes a blast of flame against the base of the stump. As the fire begins to work its way into the stump the long draft pipe, which makes the flame blast, is pushed into the stump, causing the fire to burn deeper and deeper. It requires from 20 to 30 hours to burn through a 3-ft. stump. The second furnace is then placed on the opposite side of the stump with a smoke pipe attached, the first furnace is taken away from the other side and a small draft pipe is substituted. The stump has now become a furnace, ready to burn itself, with a draft on one side and a chimney on the other. The next step in burning is to bank the stump with dirt to keep the fire inside, which will eventually consume the entire stump.

Inflating Vulcanized Tubes

After vulcanizing an inner tube, one should not inflate it immediately, for if this is done while the tube is still hot, the rubber stretches at the repaired portion. Even if the patch is not loosened thereby the tube will at least be weakened.



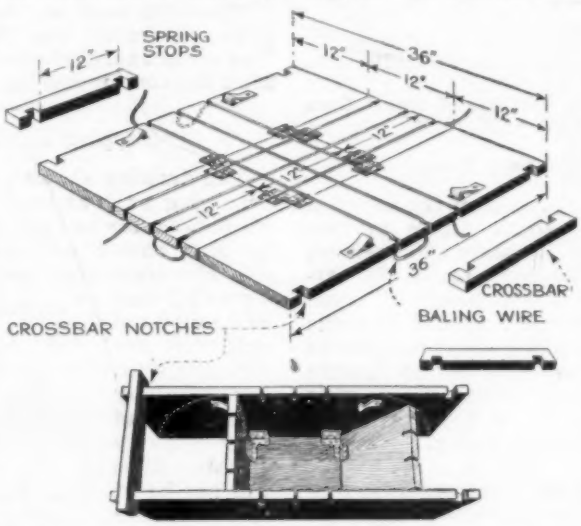
Method of Using the Wool Baler; Figs. 1 and 2 Show How the Sides and Ends Are Raised and Crossbars Slipped Over; Fig. 3, Tying of a Bundle, and Figs. 4 and 5, the Bundle After the Sides and Ends Are Dropped

Collapsible Wool Baler

By C. MORAN

WOOL growers have long felt the need for a simple baling device to replace conventional hand-tying methods. Such a baler, which has been designed by government research scientists, is shown in the accompanying photos and illustration. With it a large quantity of wool can be tied into a neat and compact bundle without difficulty.

The baler is made of 1-in. wood, cut to the dimensions given in the detail drawing. The side and end pieces are hinged to a 12 by 12-in. bottom piece, as shown. Notches are cut in the sides, near the ends, to receive 1-in. square crossbars, which are also cut out to fit into the notches. The distance between the inside of the notches on the crossbars should be exactly 12 in. Spring-steel stops, bent to the shape indicated, are screwed to the sides, the ends of the stops fitting in slots cut for this purpose, so that they can be pushed down. The stops hold the endpieces in place when the sides and ends are in vertical position, as shown at the bottom in the detail drawing. Three narrow notches are cut in the edges of each endpiece and also in the side edges, at the center, to hold baling wire.



In use, the device is laid on the floor and two lengths of baling wire are run at right angles to each other, through the narrow notches, as indicated. In this way the wire can be held in place securely while the wool is being compressed. The wool is thrown on the surface until it covers the whole baler and is about 1 ft. thick. The first operation, shown in Figs. 1 and 2, is to bring up the two sides and slip the crossbars over them. The endpieces are next brought up and pushed past the spring stops. It is then an easy matter to slip the ends of the baling wire under the opposite doubled ends and twist the wire over securely to hold it. This is done while pressing the wool down with one hand or with one foot, whichever is most convenient for the operator. After the bundle has been tied, as shown in Fig. 3, the baler is loosened. This is done by removing the crossbars which permits the sides to fall down and consequently disengages the endpieces from the spring stops. A finished bundle of wool is shown in Fig. 5.

A baler of this kind will be found of considerable usefulness, as it makes the task of tying bundles much easier, and makes them all of uniform size. Anyone can easily build it; the only material necessary is some 1-in. wood, preferably hardwood because of its superior strength, a strip of spring steel or brass and eight hinges. Of course, the press can be used for other purposes besides baling wool, the size and minor constructional details being varied to suit the work if necessary. A press of this type should not be made with the intention of using it for baling waste paper, as the time spent in the operation would be worth more than the sum received for the small bundles. Although a press larger in size than the one described might possibly be used for paper, it would be clumsy and inconvenient to handle; balers for paper must have some means of compressing the paper mechanically and keeping it compressed while the bundle is tied.

Repairing a Ratchet Jack

When repairing a ratchet jack trouble is usually experienced in finding out which pawl is not catching. If holes are drilled in the sides of the casing so that the pawls can be seen engaging the rack, the trouble can readily be located and remedied.—John A. Blaker, West Auburn, Massachusetts.

Sectional Granary Door Consisting of Several Loose Boards, Can Be Easily Opened

Handy Granary Door

A sectional granary door made of a number of 1-in. boards fitting in two grooved side rails is frequently seen on the farm. The side rails are usually vertical and the cross boards all of equal length. The trouble experienced with this arrangement is that all the boards must be raised up to the top in order to remove them, and if they fit rather snugly, this is quite difficult to do. A better arrangement is shown in the drawing. The side rails are at an angle and the cross boards have the ends cut off at a corresponding angle. Then the boards can be removed without any difficulty by raising them only a foot or two, and when they are in position they always fit snugly.

Keeping Tools Free from Rust

A good way to keep polished steel tools, such as screwdrivers, chisels, drill bits, etc., free from rust without using oil or other greasy applications, is to insert them, point down, in a wide-mouth crock filled with rice. Even in an ordinary house cellar, bright steel tools will remain perfectly free from rust for many months if this method is used, and the tools are always clean and ready for use. Now and then, of course, the rice should be changed. —James E. Noble, Toronto, Can.

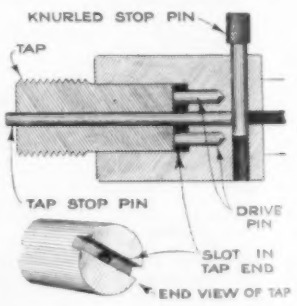
Acid-Proof Table Top

For chemical laboratories, battery-service stations, and other places where acids are handled, an acid-proof coating on the table tops is almost a necessity. The following two solutions are used for this purpose: The first consists of iron sulphate, 4 parts; copper sulphate, 4 parts; potassium permanganate, 8 parts, and water, 100 parts. The second solution consists of anilin, 12 parts; hydrochloric acid, 18 parts; water, 100 parts.

Two coats of the first solution are applied hot with a brush and allowed to dry; any dried coating that has not soaked in is then rubbed off. The surface is then given two coats of the second solution and later a thin coat of raw linseed oil is rubbed on with a cloth. If the table top is painted or varnished, it should be scraped down so that the solutions will penetrate the wood. In cases where this method was used on some old laboratory tables the result was highly satisfactory. The surface turns ebony-black a few hours after the coating has been applied.

Tapping Blind Holes

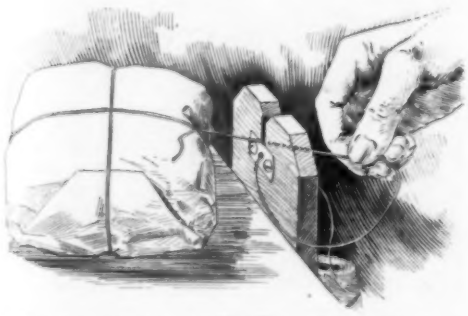
The drawing shows a good method for arranging a tap and holder when blind or blank holes are to be tapped on such work as caps, covers and the like. Work of this character may vary considerably in depth, and since, as a rule, they are not machined for anything but the thread the ordinary machine stops will not be of use. With the arrangement shown the tap will advance into the work until it reaches the face, no matter what the depth may be, provided of course, it is not deeper than the threaded length of the tap. The tap is made as usual with the exception that a hole is drilled through its center and a slot cut across the face of the shank. The holder is turned on the shank to fit the machine it is to be used in and the front end is bored out to a running fit for the tap shank. A hole, the same size as the one through the center of the tap, is drilled through the center and another hole is drilled through it at right angles; a knurled-head stop pin fits into



the latter hole, and a length of drill rod is inserted into the tap. Two pins that are driven into the bottom of holes bored in the holder complete the job. After the work has been drilled or bored to the tapping size the tap is advanced into the hole and the lead will draw it into the work until the end of the tap stop pin reaches the work. Further advance of the holder is then arrested, but the tap continues to advance until the slot in the shank is free of the drive pins, when the tap revolves with the work. The machine is then reversed, the knurled stop pin pulled up and the holder pushed forward until the pins again engage in the slot, when the tap can be backed out.

Safety Twine Cutter

Where heavy twine is used for tying packages, a safety cutter of the kind shown in the illustration will be found convenient. It consists of a piece of wood slotted vertically about one-half of its width, the slot being about ⅛ in. wide. A safety-razor blade is screwed to the side of the wood, across the slot so that it will cut the twine when pulled down through the slot. It is preferable to attach the razor blade diagonally rather than at right angles to the slot as the twine will be more easily cut by sliding it over the sharp edge of the blade than by being pulled down against it. The cutter may be attached to the edge of a bench or counter where it is used most. The twine may be threaded through the center hole of the blade so that the end is always handy when



Safety-Razor Twine Cutter Fastened Conveniently to Counter

needed. Obviously, it is almost impossible to cut one's fingers on the blade arranged in this way.

Marking Grain Bags

Marking grain bags is an easy task if done with a stencil. One can readily be made from a piece of scrap tin or other sheet metal cut to the proper size. The lettering is punched out as shown in the upper left-hand detail and a brush and some black paint are used to apply the lettering to the bag. This is a much quicker and neater method than lettering free-hand.—J. R. Koontz, Bremen, Ind.

Marking Grain Bags Facilitated by Sheet-Metal Stencil

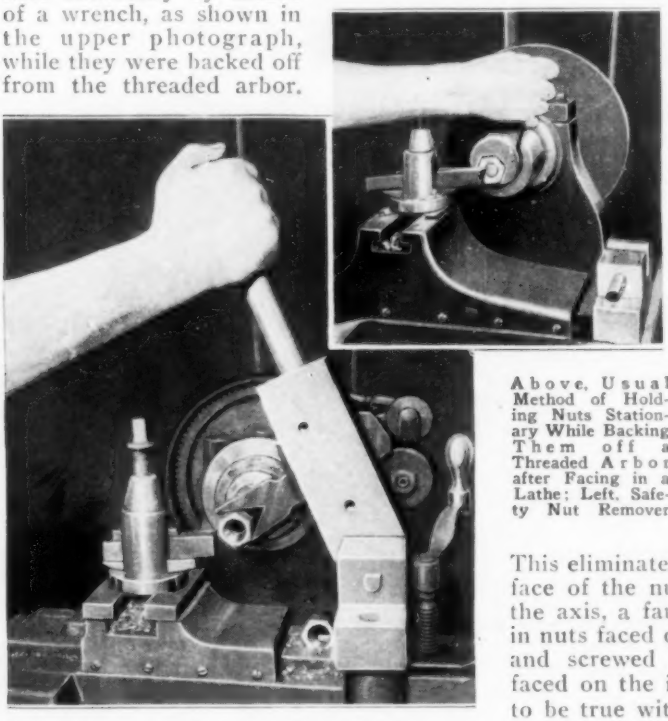
Using Spindle-Body Bushings Twice

A discarded bronze spindle-body bushing from a Ford car can be used to replace a steel spindle-arm bushing. Both ends are cut off with a hacksaw, allowing it to be slightly longer than the steel bushing. After it is driven in place both ends are peened to expand the bushing and tighten it in place. A reamer is then run through to enlarge the opening to the desired size. If the spindle arm and steering-rod yoke are worn and allow vertical play, the flange on the bushing can be ground or filed down to the proper thickness so that no washer is needed.—E. T. Gunderson, Jr., Humboldt, Iowa.

¶Keep the contact point of the toolpost setscrew oiled, to avoid wear on tool and screw and prevent the point of the screw from bushing out.

Safety Attachment for the Lathe

A factory employe whose work consisted in facing nuts in a lathe, held the nuts stationary by means of a wrench, as shown in the upper photograph, while they were backed off from the threaded arbor.



Above, Usual Method of Holding Nuts Stationary While Backing Them off a Threaded Arbor after Facing in a Lathe; Left, Safety Nut Remover

The idea worked well until his arm was drawn against the facing tool and badly cut. Then the safety device shown in the lower picture was attached to the bed of the machine. This consists of an alligator wrench, attached to a lever so that it can be pulled forward against the nut. Using this device, the machine is reversed with one hand while the lever handle is pulled forward with the other. The arbor used in this operation differs from the usual type, the threads on it being cut to the low-limit pitch diameter for a length corresponding to three-fourths of the length of the nut, and from this point tapered, .020 in. per inch, for four or five threads. The nut to be faced can be screwed on the arbor while the machine is in motion, and locks itself on the tapered thread, enabling a light facing cut to be taken. This eliminates trouble encountered if the face of the nut is not at right angles to the axis, a fault that is frequently found in nuts faced on a straight-threaded arbor and screwed against a shoulder. Nuts faced on the improved arbor were found to be true within .002 in. when tested by means of an indicator.—Chet. Shafer, Flint, Mich.

Locating Punches for Spindle Washers

Washers of different kinds are used to take up the end play in Ford-spindle arm or body joints. These washers are difficult to center so that the spindle bolts can be replaced. A good method is to use a round-ended punch which will center the washer over the hole in the spindle when it is driven down. Such punches can be made of discarded spindle bolts by cutting off the threaded part with a hacksaw and grinding the end round.—E. T. Gunderson, Humboldt, Iowa.

Concrete Posts Protect Pedestrians

Along one of the principal streets of Portland, Oreg., at the foot of a long, steep hill, reinforced-concrete posts have been provided to protect pedestrians from runaway autos. In a recent accident an auto smashed through a store front and endangered the lives of several persons who were near the store, as well as the occupants of the car. Since the erection of the posts, motorists take greater care and there is consequently less danger.

Concrete Posts on Edge of Sidewalk at Foot of Steep Hill Protect Pedestrians from Runaway Autos

Prize Offers and Announcements

$150—Best New Uses for Stop Watch

In two awards of $100 and $50; also ten additional awards of one stop watch each. These offers are made for the best lists of uses for the Pastor stop watch, which is an accurate instrument consisting of a timepiece and a stop watch in one. Particular value is placed by this concern on uses promising great savings to the user. Leading engineers claim that in the industries millions of dollars are wasted owing to lack of attention to the time element in operations. The Sterling Watch Company, Inc., wishes to learn all the uses to which the Pastor stop watch may be put. The larger one of the cash offers will be paid for the best list, the smaller sum for the second best and a Pastor stop watch, valued at $7.50, will be given for each of the next ten best series of uses received. The instrument can be examined by entrants at practically any local watch dealer's establishment. Each use should be stated briefly and simply and numbered according to its place on the list. Write on one side of the paper only, with name and address on each sheet. Address all replies to Industrial Award, Sterling Watch Company, 15 East Twenty-Sixth Street, New York, N. Y. Offer closes May 1, 1925.

$1,000—Article to Increase Brass Uses

With the person who designs some acceptable article which is composed of considerable brass in the form of sheet, rod or tubing, and which can be protected by patent, or with anyone who develops an acceptable plan wherein brass can be successfully and usefully substituted for a competing material now used in established articles of commerce, the Bridgeport Brass Company will enter into an agreement to pay royalties on the basis of such an invention, plan or suggestion, up to $1,000. The Bridgeport Brass Company will be the sole and final judge in reaching a decision regarding the commercial value of the invention, plan or suggestion, but if the company approves and enters into such an agreement in any instance, and reward is paid up to an aggregate of $1,000, payments shall then cease and the Bridgeport Brass Company shall become proprietor of all rights, privileges and returns from the promotion, manufacture or sale of any such patent, plan or suggestion the Bridgeport Brass Company adopts under this offer. May 1, 1925, is closing date for this offer. Address Bridgeport Brass Company, Bridgeport, Conn.

$1,000—Adjustable Miter Box

The sum of $1,000 in cash and a satisfactory royalty will be paid by Roche and Moore for a suitable miter box for carpenters, to be employed with the ordinary handsaw. The design must be such that it can be easily and quickly adjusted to any arc of a half circle. It should be one inexpensive to manufacture, should be light in weight and preferably planned to be constructed of either wood or steel. No models of suggested designs should be submitted until after the drawings or sketches have been sent to the donor. This concern reserves the right to be the sole judge of the merits of all ideas submitted and their availability for adoption by our organization. Address Roche and Moore, Cochranton, Pa. This offer expires May 1, 1925.

$25—New Uses for Cel-o-Glass

The sum of $25 will be paid by Cello Products Incorporated for each suggested new use for its product, Cel-o-Glass, provided said use is of such character as to open up an entirely new and definitely accessible market for the sale of this adaptable material. Entries will be judged by the company alone. In case of duplication of suggestions, preference will be given to the one first received. List of present uses and other information can be had from the donor. Address all replies to Cello Products Incorporated, Box 28, 89 Fulton Street, New York, N. Y.

OFFERS ANNOUNCED IN PREVIOUS ISSUES

All of These Offers Expire May 1, 1925

FOR THE BEST SUGGESTED IMPROVEment on a gasoline-heated blowtorch and soldering and branding iron combined an award of $500 will be paid by the Everhot Manufacturing Company.

AWARDS OF $500 EACH WILL BE PAID for a waterproofing process for a library paste and a method that will produce increased sales of this product. John J. Harris and Company.

$2,000 WILL BE PAID BY THE NORTH Shore Food Products Company for a method of processing or preserving cottage cheese to keep it fresh for at least two weeks.

THE CARR FASTENER COMPANY WILL pay $500 for a reservoir grease cup which can be filled with a grease gun and feed out the grease at a slow rate.

FOR NEW WAYS OF USING BUTTON molds $500 will be paid by donor in Problem HA-1, and the same concern will pay $500 for new uses for button-mold machines as stated in Problem HA-2.

THE SUM OF $50 IS OFFERED BY THE Parsons Manufacturing Company for the best plan they receive for uses of ground slate.

TO THE PERSON SUBMITTING TO THEM an article which they can make in their machine and electrical shop, the Guyan Machine Shops will pay $250 over and above its royalties or sales price.

GRANITE STATE MOWING MACHINE COMpany offers $500 in cash and royalties for satisfactory working drawings for gasoline-motor lawn mower they accept for manufacture and marketing.

NATIONAL BRASS COMPANY WILL PAY $300 for design of key guide that can be made of sheet metal and which will properly fit escutcheon plate of similar material.

TO ANYONE WHO WILL PRODUCE FOR them a saxophone reed to satisfactorily replace the present reed, the Buescher Band Instrument Company will pay the sum of $1,000.

THE PHENIX RADIO CORPORATION WILL pay the sum of $1,000 for the design of a new form of condenser for radio reception.

FOR A SATISFACTORY HAMMER-BLOW arrangement for portable hammer drill, the Wodack Electric Tool Corporation will pay $500.

$2,000 WILL BE PAID IN SEVERAL AWARDS for processes and machines for salvaging waste lumber. National Lumber Manufacturers' Association.

FOR SKYROCKET STICK HARMLESS IN descent, $1,000; bombshell with illuminated flag, $250; chemical combinations to produce smokeless fireworks colors, $250. Thearle-Duffield Fireworks Company.

MOTOR-OPERATED HANDSAW FOR MANUfacture and sales; award, $10,000 in royalties. R. L. Barker and Company.

ELECTRIC HEATING ELEMENT WHICH will operate and interchange with base and cover of Imperial self-heating gasoline iron, $500. Imperial Brass Company.

DISCOVERY OF NEW USES FOR CARBONdioxide gas or improvements to present uses. Award $1,000.

Full Details Regarding the Previous Offers Listed Above, May Be Obtained by Addressing the Bureau of Information, Popular Mechanics Magazine

Radio in the Wilderness

Radio Questions and Answers

Q. Can you tell me why I am unable to get low wave lengths on my three-tube set? I get all the way from 340 to 560 meters. A. Either your inductance is improperly tapped or you are not using a tuning condenser in the aerial or ground lead. Try putting a .43-plate condenser in series with the ground.

Q. Does it make any difference where the lead-in wire is connected to the antenna? Will there be any difference if two antennas are within 5 ft. of each other? A. It is better to connect the lead-in wire at the end of the antenna nearest the set. If the two antennas are not run parallel to each other, the distance should be all right, otherwise it should be increased to 8 or 10 ft. However, parallel antennas do not give as good results as when they are at an angle to each other.

Q. I have been troubled by what I thought was static, but the noise continues even after the ground and aerial are disconnected. What is the trouble? A. There is probably a faulty connection in your set. The difficulty might be eliminated by resoldering all doubtful connections until the right one is found. The trouble may also be caused by dust between the plates of the condenser, or the sliding contact in the rear may have become corroded; possibly also the B-batteries are defective.

Q. I cannot understand why low-ratio audio-frequency transformers are used in most circuits. Why not use transformers of higher ratios and get louder signals? A. Both high and low ratios will work, but the reason for using the lower ratios is to prevent distortion. It is better to have a little less volume and obtain clearer signals.

Q. I have a regenerative set, with a variometer and variocoupler, and use one tube. I can get signals, but the variometer does not seem to affect the volume. In other words it will not regenerate. Can you solve my problem? A. Your trouble may be in the grid leak; try a variable one. You may have a defective tube, or you may not have the proper plate and filament voltages. Change the grid leak first, then look to your A and B-batteries and see that they are in good condition, and that the right voltage is applied. You may have too little or too much voltage for proper operation.

Q. I have just built a spark sending station. Is there any way that I can listen in on it for the broadcasting stations? A. No, your transmitter will do nothing but send. The receiving instrument is a separate device. It is always best to obtain some simple book on radio before attempting to build transmitters and receivers, so that you may thoroughly understand the principles involved before going to any expense. It is also necessary to obtain a license from the radio inspector of your district before you can operate a transmitting instrument. No license is required for using a radio receiver.

Q. Being a reader of your magazine, I am taking the liberty to ask you a few questions. I wish to put up an aerial in the best possible way. Should I use iron pipes for the masts, or would it be better to use wood? How far should the masts be apart, and how high shall I make them? Is it best to run it north and south or east and west? A. Iron pipes make an ideal support for the aerial. Use a single wire from 75 to 100 ft. long and place the masts far enough apart to accommodate this length of wire. The higher you can elevate the aerial the better. It should be placed so that the lead-in end points toward the direction from which you expect to receive the largest number of stations. No. 14 copper wire or stranded antenna wire will give good results. Carefully solder all connections, and use good insulators.

Q. I would like to make a simple crystal receiver, but do not wish to invest much as it is for a small boy. Can you refer me to some article on the subject? A. In the January, 1924, issue we described a very simple crystal receiver of this type. If you do not have this back number you can obtain it from our subscription department at the usual price. All construction details are given in the article, and the instrument can be built for about 75 cents.

Q. My neighbor is uneasy because I have an aerial on the roof. We live in an apartment building and he is afraid that lightning will strike the aerial. Of course, this is foolish, but I have taken it down to please him. Can you suggest some other means for me to build an aerial that I can use with the receiver I now have? I do not feel like building a more expensive set at this time. I have a five-tube neutrodyne receiver. A. Your neighbor is unduly alarmed. A well-built aerial, properly insulated and provided with an approved lightning arrester, is a protection to a building rather than a hazard. However, if you wish to operate your receiver on an inside aerial, place two or three turns of bell wire behind the picture molding of the room, taping the far end and bringing the other end down to the aerial binding post of the receiver. This type of aerial will work very nicely and you will get surprising distance with it.

The Radio Department is willing and anxious to serve you. If you contemplate buying or building a set, we will be glad to advise you in selecting the proper instrument to suit your purpose, furnish you a circuit, or tell you where to get the best parts. When you run into trouble in building or operating your set, tell us about it, and we will endeavor to clear it up for you.

Address all inquiries to the Radio Editor, Popular Mechanics Magazine, 200 E. Ontario St., Chicago.

Q. I have a 23-plate variable condenser, and am told that it is of .0005-mfd. capacity. Is this correct? I am anxious to know as a .0005-mfd. variable condenser is specified in the circuit I wish to use. A. The statement that the condenser is .0005-mfd. capacity cannot be made unless you have the authority of the manufacturer for it, or have tested it yourself. In former years, it was the practice of the various manufacturers and writers to state that the 11-plate variable condenser was of approximately .00025-mfd. capacity, the 23-plate condenser .0005-mfd., and the 43-plate condenser equivalent to .001 mfd. Variable condensers are no longer made in a standard pattern, materials differ, plates are larger and in some cases smaller, spacing and design differ, so the safest method is in all cases to be guided by the rating given by the manufacturer.

Q. I have a radio receiver consisting of a single-circuit tuner, with grid and plate coil. It is not selective. How can I make it more selective? A. Wind a separate aerial coil on a form the same diameter as your grid coil, putting 10 or 12 turns of No. 22 cotton-covered wire on this coil, and mount it about ½ in. from the secondary or grid coil that you now have, putting the coils in inductive relation to each other. Connect the aerial and ground to the ends of this coil instead of to the grid coil as you now have them.

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